Work Plan
for
Community Health Program Pilot Study
In Support of Remedial Design
for
Operable Unit 1
Vasquez Boulevard/Interstate 70 Superfund Site
Denver, CO

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Prepared for:

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VASQUEZ BOULEVARD/INTERSTATE 70 SUPERFUND SITE
WORK PLAN FOR COMMUNITY HEALTH PILOT STUDY IN SUPPORT OF REMEDIAL DESIGN

This work plan has been prepared at the request of the U.S. Environmental Protection Agency, Region 8, by MFG, Inc. and Tetra Tech EM Inc. to describe a pilot-scale study that will be conducted to evaluate sources of children's lead and arsenic exposures at individual residential properties to support remedial design for Operable Unit 1 of the Vasquez Boulevard/Interstate 70 Superfund Site.

TITLE AND APPROVAL SHEET

The following are responsible for development of the work plan for community health pilot study in support of remedial design at the Vasquez Boulevard / Interstate 70 Superfund Site:

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This work plan is approved without conditions

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LIST OF ATTACHMENTS

ATTACHMENT	TITLE
A	Standard Operating Procedures
B	Forms
C	Quality Assurance Project Plan
D	Health and Safety Plan

LIST OF ACRONYMS

ATSDR	Agency for Toxic Substance and Disease Registry
CDPHE	Colorado Department of Public Health and Environment
DDEH	Denver Department of Environmental Health
EPA	United States Environmental Protection Agency
GFAA	Graphite-Furnace Atomic Absorption spectrometry
HUD	United States Department of Housing and Urban Development
ICP	Inductively Coupled Plasma-Atomic Emission spectrometry
KAP	Kids At Play
NDHC	Northeast Denver Housing Center
OU	Operable Unit
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
SOP	Standard Operating Procedure
UCHSC	University of Colorado Health Sciences Center
VB/I-70	Vasquez Boulevard/Interstate 70
XRF	X-Ray Fluorescence

1.0 INTRODUCTION

This plan describes a pilot-scale study that will be conducted to evaluate sources of children's lead and arsenic exposures at individual residential properties to support remedial design for Operable Unit 1 of the Vasquez Boulevard/Interstate 70 (VB/I-70) Superfund Site.

The VB/I-70 Superfund Site includes an area of approximately 4 square miles in north-central Denver, Colorado. The site has been divided into three operable units (OUs). The residential area discussed in this report is OU1. The locations of the former Omaha and Grant Smelter and Argo Smelter are OU2 and OU3, respectively. The OU1 portion of the site includes residential properties in the neighborhoods of Swansea/Elyria, Clayton, Cole and portions of Globeville. There are more than 4,000 residential properties within the site, most of which are single-family dwellings. The site also contains a number of schools, parks and playgrounds.

A Remedial Investigation (RI) performed by the U.S. Environmental Protection Agency (EPA) identified elevated levels of arsenic and lead in soil at some of the residential properties within this site (Washington Group, 2001). Based on the findings of the RI and the subsequent Baseline Human Health Risk Assessment (EPA, 2001), EPA has concluded that soils at some of the residential properties within the site contain arsenic and lead at levels that represent a risk to human health.

In May 2002 EPA issued the Proposed Plan for OU1. The public comment period ended on July 19, 2002, and EPA is in the process of selecting a remedy. The preferred alternative described in the Proposed Plan includes a community health program component, which would be implemented to reduce risks to young resident children from exposure to lead from a variety of non-soil sources and arsenic from soil pica behavior. One component of the community health program, as currently scoped, is performance of environmental testing at the homes of children who have elevated blood lead or urinary arsenic levels. The testing would be performed to identify the likely sources of their lead and arsenic exposure and provide the information needed to assist families in reducing their child's exposures to those sources. The pilot study described by this plan is being conducted to support the design of the community health program by implementing, on a small scale, the procedures that would likely be used to collect environmental and exposure data as part of a full-scale community health program. The information collected will ultimately be used to support the design for a full-scale community health program, if selected by EPA as part of the remedy.

The pilot study will also support a community health survey, known as "Kids at Play" (KAP), that is being performed this summer within the VB/I-70 site. The Colorado Department of Public Health and Environment (CDPHE) and the University of Colorado Health Sciences Center (UCHSC) have been awarded a grant from the Agency for Toxic Substances and Disease Registry (ATSDR) to conduct the KAP health survey. The door-to-door survey includes (1) a census to count resident children less than 6 years old, (2) completion of questionnaires about child behaviors related to soil contact and (3) collection of blood samples for lead analysis and urine samples for arsenic analysis. EPA is performing the chemical analyses of these biological samples. The KAP health survey will also provide health education to families with children who have either elevated blood lead level (defined as greater than or equal to 10 μg/dL) or urinary arsenic above the national background (defined as greater than or equal to 30 μg/L), or both. However, the survey does not include any follow-up environmental investigation or response. EPA agreed to perform an environmental investigation at the homes of children who have either a blood lead level ≥ 10 μg/dL or a urinary arsenic level ≥ 30 μg/L, or both. The KAP health survey provides an opportunity to pilot the procedures that are being considered by EPA for inclusion in the full-scale community health program.

1.1 Background

As currently envisioned, the community health program would be implemented to assist resident families in reducing their children's exposure to lead from sources other than soil and arsenic from soil pica behavior. The most effective means of providing this assistance will be to support the local health department, Denver Department of Environmental Health (DDEH), in their efforts and to coordinate with existing public health (e.g., CDPHE) and non-profit agencies, such as the Northeast Denver Housing Center (NDHC), in addressing children's health within the VB/I-70 site. At present, and due to their limited resources, DDEH is only able to respond to cases for children with blood lead levels of 15 μg/dL or above. The community health program would support DDEH by responding to children with blood lead levels of 10 μg/dL or above. Also, it is envisioned that under the community health program EPA would collect environmental data that would assist NDHC in performing their lead-based paint risk assessments. As an added benefit, the community health program will provide EPA with the types of additional data that are needed to further evaluate the effectiveness of the overall remedy, which will include soil removal and replacement. The community health program would include four main components:

- a biomonitoring program to provide routine and follow up blood lead and urinary arsenic screening to young children residing within the site (in accordance with CDPHE's blood lead screening plan);
- community outreach and educational services to increase awareness about risks from exposure to various potential sources of lead and potential arsenic exposure for children with soil pica behavior and reduce childhood lead and arsenic exposures;
- environmental investigation at properties where resident children have elevated blood lead or urinary arsenic levels; and
- referrals to appropriate local health and public service agencies for case-management and lead-based paint abatement services.

The program's services would initially be provided by an EPA-led entity; however, EPA's intention is to establish a program that would eventually be managed and administered through the cooperative efforts of the local health and housing agencies that currently serve this community and its residents.

1.2 Pilot Study Objectives

The primary objective of the pilot study is to collect information that can be used to evaluate children's exposures to lead and arsenic in and around their homes to support remedial design of a community health program. Data collected through the pilot study will be used to characterize sources of lead and arsenic at selected residences and identify risk factors that may contribute to an individual child's exposure and health risks. The data collected through the pilot study will also be provided to each participating family and to existing health agencies serving the community so that appropriate actions may be taken to immediately address individual children's exposures to lead and arsenic.

Results from the pilot study will also be used to refine the final design of the community health program, if it is included in the remedy selected by EPA in their Record of Decision. The pilot study results may prove beneficial in identifying (1) any site-specific risk issues, which should be the focus of community awareness and education programs; (2) the types of data most needed to assist the DDEH in case management of children with elevated blood lead levels and non-profit agencies that provide lead-based paint abatement assistance; (3) the types of data most needed to recognize and assist children with soil pica behavior; and (4) recruitment strategies that will maximize resident participation in the community health program.

The pilot study also provides an opportunity to initiate coordination among the various existing agencies that participate in environmental risk reduction activities within the community. During the

pilot study, EPA will be working with these agencies as described by this work plan. At the completion of the pilot study, EPA will work with DDEH and NDHC to evaluate whether the level of interagency cooperation and coordination of services can be improved during implementation of a full-scale community health program.

1.3 Pilot Study Design

The pilot study will include investigations at approximately 20 residential properties where young children with elevated blood lead or urinary arsenic levels reside. EPA will rely on the blood lead and urinary arsenic test results from the KAP health survey being conducted within the VB/I-70 site during the summer of 2002. Participants will be recruited from the families who have children with elevated blood lead or urinary arsenic levels. Once those families have been identified by CDPHE and UCHSC, EPA will request their voluntary participation in the study.

An environmental investigation will be performed at the homes of participating families, and at the same time an interview will be conducted to obtain information about the family, child behaviors and the home environment. The environmental investigation will focus on identifying potential sources of lead or arsenic exposure in and around the home. For situations where the child has an elevated blood lead, yard soil, indoor and outdoor paint, indoor dust and drinking water will be tested for lead content. For situations where the child has an elevated urinary arsenic level, yard soil and selected other potential sources of exposure will be tested for arsenic content. Other potential sources of lead and arsenic and risk factors for exposure, such as occupational exposures, hobbies, kitchenware, home remedies and exposures in day care settings, will be identified through the interview process. The interview will also include questions about the home's condition, the family's habits and child behaviors. Before conducting an interview, EPA will request the family's completed KAP questionnaire from CDPHE and, if those results are provided, EPA will make every attempt to not duplicate the questions asked of the family by CDPHE.

As described above, EPA will provide the environmental investigation data collected at each property to the participating family and to local health and housing service agencies. EPA will also review the information collected at each property, on a case-by-case basis, to evaluate the potential sources of lead or arsenic exposure for each of the elevated blood lead or urinary arsenic children. The evaluations will be summarized in a Technical Memorandum prepared at the end of the pilot study.

1.4 Document Organization

The remaining sections of this plan describe the work elements of the pilot study (Section 2); coordination with local health agencies (Section 3); procedures for data management and reporting (Section 4); and the pilot study schedule (Section 5).

2.0 WORK ELEMENTS

The pilot study has three main elements of work: (1) study set up and participant recruitment; (2) administration of family interviews to collect exposure-related information about the homes of children with elevated blood lead or urinary arsenic levels; and (3) environmental testing for lead and/or arsenic at individual residences. These elements are described separately below.

2.1 Study Set Up

The blood lead and urinary arsenic levels of young children residing within the VB/I-70 site will be measured as part of the KAP health survey that is being performed this summer (June–August 2002) by CDPHE, UCHSC and EPA. The door-to-door health survey will include a census to count young children (less than 6 years old), completion of questionnaires about child behaviors related to soil exposure, and collection of blood samples for lead analysis and urine samples for arsenic analysis. According to the study protocol for the KAP health survey, results from the study's screening tests will identify young children who have either elevated blood lead ($\geq$ 10 µg/dL) or urinary arsenic levels ($\geq$ 30 µg/L), or both, in initial and confirmatory samples. From these data, CDPHE and UCHSC will then identify families for recruitment into EPA's pilot study.

2.1.1 Recruitment

The CDPHE and UCHSC will approach families who have at least one child with a confirmed elevated blood lead or urinary arsenic level to request their voluntary participation in EPA's pilot study. At that time, the study's objectives, design and possible benefits to the family will be fully explained, and a family representative will be asked to sign an access agreement for EPA. A letter from EPA, a Fact Sheet explaining the pilot study and the Access Agreement form that will be provided to each family by UCHSC are included in Attachment B of this plan.

For families that agree to participate by signing the access agreement, USHSC will provide EPA with the following information: family name, address, telephone number and indication of whether there is an elevated blood lead level or urine arsenic level, or both.

Due to the confidential nature of medical test results associated with their study, the UCHSC cannot release the actual result values for individual children. This information will not be necessary for EPA to have as part of the pilot study, but EPA will request that participating families release their

children's blood lead and urinary arsenic test results for use by the study (refer to Data Release Form, Attachment B). EPA will retain the confidentiality of released medical information by restricting access to the data and avoiding reference to information that could be used to identify individual children, or properties, when reporting results from the pilot study. Released blood lead and urinary arsenic data would be used to help manage children's exposure to lead and arsenic and to assist with interpretation of the pilot study results as a whole. Families will not be required to release their children's screening results in order to participate in the pilot study.

2.1.2 Access

The property owner's consent for access must be obtained in writing prior to conducting environmental testing at an individual home. In the case of rental properties, access must be granted from the property owner for soil sampling and from the current tenant for interior paint, dust and water sampling. When requesting access from residents on behalf of EPA, UCHSC will explain the type of testing that will be performed and describe how these data will be used. EPA will request access from property owners. The access agreement grants EPA permission to sample the property and use the data collected. EPA will not schedule any environmental investigation visit until receiving a signed access form, or forms, for the property to be tested.

2.1.3 Scheduling

Upon receiving a signed access agreement, EPA will schedule a home visit with each of the participating families by phone. An EPA representative will discuss the nature of the environmental testing, time required, any advance preparations needed for testing and the interview procedure to the residents by phone before setting up a time for the property visit. In the case of a family with a child having an elevated blood lead level, EPA will coordinate the schedule for the home visit with DDEH.

The investigation will be implemented in a manner that minimizes disruption and inconvenience at each residence investigated. EPA will schedule sampling at times convenient to residents. EPA will request that an adult resident who has child-care responsibilities for the subject child (i.e., child with elevated blood lead or urine arsenic result) be present for the duration of the home visit and the interview. If necessary, home visits may be scheduled during the evenings or weekends to accommodate residents' work schedules. Whenever possible, all sampling will be performed during a single visit. The collection of outdoor samples will be dependent on weather conditions.

2.2 Pilot Study Scope at Individual Properties

The scope of the pilot study's environmental investigation will vary depending on the blood lead and urinary arsenic test results for resident children at each property. For properties where a resident child has a confirmed elevated blood lead level but no elevated urine arsenic level, the environmental investigation will include the family interview and exterior and interior paint testing; dust sampling; water sampling and soil sampling for lead analysis. For properties where a resident child has an elevated urine arsenic level but no elevated blood lead level, the environmental investigation will include the family interview and soil sampling for arsenic analysis. Focused dust sampling may also be included if an exterior dust source is indicated as a possible source of arsenic exposure. For properties where a child has both elevated blood lead and urine arsenic levels, the environmental investigation will include the family interview; exterior and interior paint testing, dust sampling and water sampling for lead; and soil sampling for lead and arsenic analysis.

2.3 Family Interview and Questionnaire

Information about the home environment and exposure-related behaviors of children with elevated blood lead or urinary arsenic levels will be collected through a face-to-face interview with a family member. The family interview will be performed immediately prior to the in-home environmental testing. The purpose of the interview is to collect information about the family, their children and their residence, but the interview will also be used as a means to explain the environmental investigation elements to the family and provide them with educational information about potential sources of lead and arsenic and prevention of exposure to levels of lead and arsenic considered hazardous to children's health.

The interview will be performed by a representative from either the EPA or DDEH using the Family Interview Questionnaire included in Attachment B. DDEH will be given the first opportunity to conduct the interview at homes of children with elevated blood lead levels. If DDEH declines, the interview will be conducted by an EPA representative instead. The Family Interview Questionnaire includes questions about housing age and condition, remodeling activities, cleaning habits, occupation and hobbies of family members, individual children's mouthing behaviors, play behaviors and play areas.

2.4 Environmental Testing for Lead

The environmental-testing component of the study will collect data to describe lead levels in interior and exterior paint, indoor dust, bare-area yard soils, and drinking water at the residences of participating families. Environmental testing for lead (paint, dust and soil sampling) will be performed by a State-certified risk assessor for lead-based paint hazards using the procedures described below and detailed in Attachment A.

2.4.1 Paint Testing

The paint inspection and testing protocols presented in this plan have been developed to identify lead-based paint in poor condition and locate potential sources of direct lead exposure and lead in house dust and yard soil. The procedures for testing exterior and interior paint are based on the U.S. Department of Housing and Urban Development (HUD) *Guidelines for Evaluation and Control of Lead-Based Paint Hazards in Housing* (HUD, 1995). Paint testing will be performed by a lead-based-paint risk assessor who is trained and certified in accordance with requirements of the Colorado Air Quality Control Division's Regulation 19. All paint testing for lead will be performed in accordance with the Standard Operating Procedure (SOP) for Paint Testing (MFG-VBI70-02) (Attachment A).

At each property investigated, the paint investigation begins with the Family Interview Questionnaire (refer Section 2.4), which provides the risk assessor with information regarding potential sources of lead exposure within and outside of the home. A visual assessment of paint conditions is then performed using the visual inspection procedures included in HUD's *Guidelines for Evaluating Lead-Based Paint Hazards in Housing* (HUD, 1995) and detailed in the SOP for Paint Testing (Attachment A). After the questionnaire and visual assessment have been completed, interior and exterior paint testing will be performed.

The lead content of interior and exterior paint will be tested *in situ* using a portable X-ray fluorescence (XRF) spectrometer. The paint testing method is non-destructive to paint and will not damage painted surfaces or underlying substrates. Detailed procedures for operating and maintaining the XRF instrument are provided in the SOP for Paint Testing and Assessment (Attachment A).

Interior Paint Testing Plan

The condition of interior paint will be assessed using the procedures detailed in the Paint Testing SOP (Attachment A). The visual assessment will be used to identify areas of the home for paint testing.

Interior paint will be tested in areas of the home frequented by young children (e.g., main living areas, children's bedrooms, kitchen, etc.) where deteriorated paint is present. As such, the areas of the home to be tested will depend on the results of the visual assessment and family interview. Deteriorated paint present on any painted furniture, cribs, toy closets or other areas that a young child may routinely and frequently come into contact with may also be tested. This approach will allow for identification of lead-based paint hazards throughout the home.

The lead content of deteriorated paint on walls, window and door components and moldings will be determined. In single rooms with walls that show deteriorated paint but distinct painting history for the various walls, each wall may be tested. For window components with deteriorated paint, paint on the window casing, sash and interior sill will be tested. When multiple windows with the same painting history are present, paint testing will focus on the oldest appearing painted working window in the room. If none of the windows in the room are in working condition, either the oldest appearing window or a window selected at random will be tested. For door assemblies with deteriorated paint, the lead content will be measured on the casing, the jamb (a possible friction surface) and the door. When multiple doors with the same painting history are present, testing may focus on the door likely to receive the most use. Molding or decorative trim that is accessible to young children (less than 4 feet above the floor level) will be tested if deteriorated paint is present. The lead content of deteriorated paint on molding will be measured for each type of molding in the room, such as baseboard and chair rail types, which may have distinct painting history. If the paint on crown molding is in poor condition, it will also be tested. Other painted areas that may represent a source of exposure for young children, such as painted cabinets, may also be tested.

Exterior Paint Testing Plan

Paint on the exterior of the home and other structures (e.g., garage, storage shed) on the same property will also be visually assessed and tested when necessary.

The visual assessment will be performed first to identify any areas of deteriorated paint. If deteriorated paint is present, it will be tested for lead content. Testing may include exterior walls, entry

doors and jambs, window assemblies and the horizontal or vertical trim components on the home. For windows, measurements will be obtained from the sill, casing, jamb and sash. For doors, the casing, jamb and door will be tested. Horizontal and/or vertical trim components will be tested on the side of the house where the paint is in the poorest condition. In addition, painted fences and painted storage sheds or other outbuildings on the property will be tested if the paint is in poor condition.

2.4.2 Dust Sampling

Sources of lead to interior house dust include outside sources such as soil and air emissions and also lead-based paint. The amount of dust and the lead concentration in dust may vary throughout a house. For this reason, dust will be collected from at least three areas of the home, including (1) heavy traffic areas such as main entries where tracking from outdoors may result in elevated lead levels in dust, (2) areas that are most accessible to children such as play areas and (3) areas where the paint is in poor condition (if any). The risk assessor will always select locations for dust sampling based on the results of visual paint assessment, family interview and family use patterns. A State-certified risk assessor will select sampling locations and collect the dust samples.

Dust samples will be collected from window sills and window troughs and from both carpeted and hard-surface floors. At each home, dust samples will be collected from a minimum of three windows and three floor areas. Typically, the floor areas sampled will include high-traffic and high-use areas of the home such as the main entry, the primary entry to the main living area and the entry to a young child's bedroom. Dust samples may also be collected from other areas of the home frequented by that child and areas where paint is in poor condition.

Floor dust samples will be collected for analysis of lead in accordance with the Vacuum Dust Sampling SOP (MFG-VBI70-04) and Dust Wipe Sampling SOP (MFG-VBI70-03) (Attachment A). At each of the floor dust sampling locations, dust will be collected from a carpeted area using a battery-operated air pump to collect dust in a pre-weighed filter cartridge. If there are no carpeted areas within the room to be sampled, then the vacuum dust sample will be collected either from an uncarpeted floor area with a high dust load, such as a corner or along walls, or a carpeted area immediately adjacent to the room. If there are two separate carpets in a room, such as an area rug overlying wall-to-wall carpeting, the area rug will be sampled since it is the most likely source of exposure for a young child.

Using a sampling template, a one-square-foot area will be completely vacuumed using the air pump to collect the dust present. This procedure is documented in EPA's *Residential Sampling for Lead: Protocols for Dust and Soil Sampling* (EPA, 1995) and included in the SOP for Vacuum Dust Sampling (Attachment A). Dust samples will be shipped to an offsite laboratory for analysis of lead by flame atomic absorption spectrometry (EPA SW-846 Method 7420), as described by the Quality Assurance Project Plan (QAPP) in Attachment C. Results from lead analysis will be reported in mass of lead per unit mass of dust (e.g., mg/Kg), and the mass of dust collected will also be reported. These results will then be used to compute the lead load as the mass of lead per unit area (e.g., mg/ft^2).

In addition to the vacuum samples of floor dust, dust wipe samples will also be collected from hard-surface floors and from window components. One dust wipe sample will be from an area of hard-surface flooring in each room where a vacuum floor dust sample is collected or a nearby area (as conditions at individual homes allow). One dust wipe sample will also be collected from one window sill and one window trough in each room where floor dust samples are collected. Wipe samples from window components will be collected from a working window (i.e., window opens and closes). If there are no working windows in the room, then another area of the home may be selected for dust wipe sampling of window components.

The methods for collecting dust wipe samples are described in the SOP for Wipe Dust Sampling included in Attachment A. The dust wipes will be analyzed for lead, and results will be reported as a lead load per unit area (e.g., mg/ft^2).

For all dust samples, the exact location and type (wipe/vacuum, carpeted/uncarpeted) of sample will be described in field notes and recorded with other sample information.

2.4.3 Drinking Water Sampling

Drinking water samples will be collected in accordance to the Drinking Water Sampling SOP (MFG-VBI70-05) (Attachment A). Water samples will be collected from the main tap (cold water tap) used for drinking water in each home, typically at the kitchen sink. Two samples will be collected from this source: one to represent water held in the faucet and nearby pipes for an extended period of time, i.e., overnight, and one to represent water flushed through the house pipes. The first sample will be collected following a 6- to 8-hour period during which no water passes through the faucet. This will be described as the "6- to 8-hour hold" sample. The second sample will be collected from the same faucet after a

period of pipe flushing. The pipes will be flushed by running water fully for 30 seconds. After 30 seconds, water will be collected directly from the faucet flow. This sample will be referred to as the "30-second flush" sample.

Water will be collected from the faucet directly into one 1-liter sample container supplied by the laboratory and preserved, using nitric acid, to a pH less than 2 (refer to QAPP, Attachment C). The samples will be securely sealed and labeled at the sampling location and then stored on ice or refrigerated *at 4 degrees Centigrade. Water samples will also be refrigerated during transport to an offsite laboratory.* Water samples will be analyzed for lead using EPA Method 200.9, graphite-furnace atomic absorption spectrometry (GFAA) or an equivalent method (see Attachment C, QAPP). Procedures for chain of custody and sample preservation, shipping and handling are included with SOPs in Attachment A.

To facilitate collection of the 6- to 8-hour hold sample at a convenient time, residents may elect to collect water samples themselves. If the resident volunteers to collect water, the EPA will supply the sample containers and detailed instructions regarding sample collection. An EPA representative will pick up the samples at the home and will submit the water samples to a laboratory for lead testing.

2.4.4 Soil Sampling

Yard soil samples will be collected in accordance with the Soil Sampling SOP (MFG-VBI70-01) (Attachment A). EPA may collect two types of soil samples during the pilot study: (1) Phase III Field Investigation (EPA, 1999) soil samples at residential properties, schools, day-care facilities and parks that have not been previously sampling using the "Phase III methodology" and (2) soil samples to identify potential lead exposure hazards in residential yards. Phase III investigations will only be performed as part of the pilot study if a property has not been previously sampled using those procedures. Phase III investigation samples will be analyzed for lead and arsenic. Hazard identification sampling will be performed at all properties included in the pilot study. Separate procedures are provided in the Soil Sampling SOP (Attachment A) for collecting these two types of samples.

Before initiating soil sampling to identify potential lead-exposure hazards, EPA will review all existing records of measured lead levels in yard soils at the property. EPA has already collected grab samples at a number of the properties sampled during the Phase III investigation. If such samples have already been collected, then those results will be used to assist samplers in selecting areas for sampling to support the lead-exposure evaluation.

The soil sampling performed to identify potential lead-exposure hazards will focus on areas of the yard where bare soil is present and readily accessible to young children. Examples of yard areas where bare soil is likely to be present include the foundation area or dripline around the home, play areas, garden areas or pet areas. The lead results for soils collected from these targeted bare areas will be provided to NDHC for their use in performing a lead-based paint risk assessment to evaluate potential sources of lead exposure for young resident children.

The results from the Phase III field investigation will be used by EPA to determine the average lead concentration in yard soil for comparison to the action level for soil remediation.

The sampling methods used at properties where a lead investigation is performed are consistent with those included in HUD's guidelines for evaluation of lead-based paint hazards. For each bare area, a composite sample from the top half-inch of bare soil will be collected for lead analysis. A detailed description of the hazard investigation soil-sampling procedure for lead is included in the Soil Sampling SOP (Attachment A).

All surface soil samples collected for lead analysis during the pilot study (i.e., Phase III investigation samples and hazard identification samples) will be shipped to an offsite laboratory for analysis. Soil analyses for lead will be performed in accordance with EPA's SW-846 Method 6010B, inductively coupled plasma-atomic emission spectrometry (ICP) analysis. Phase III soil samples will be prepared for analysis in accordance with the Phase III investigation procedures (refer to Soil Sampling SOP, Attachment A) and ICP analyses. For composite samples collected to evaluate lead hazards, the entire sample volume submitted will be disaggregated, dried and sieved by the laboratory to homogenize prior to analysis. The less than 2-mm size fraction (passing 10-mesh sieve) will be used for analysis. Both Phase III and hazard-investigation samples will be digested prior to ICP analysis using EPA's Method 3052 (microwave-assisted acid digestion using hydrofluoric acid). Quality control methods for laboratory analyses of soil samples are provided in the QAPP (Attachment C).

2.5 Environmental Testing for Arsenic

The environmental testing component of the study will collect data to describe arsenic levels in yard soils, including any known play areas and bare areas of the yard at the residences of participating families.

2.5.1 Soil Sampling

Yard soil samples will be collected in accordance with the Soil Sampling SOP (MFG-VBI70-01) (Attachment A). EPA may collect two types of soil samples during the pilot study: (1) Phase III Field Investigation (EPA, 1999) soil samples at residential properties, schools, day-care facilities and parks that have not been previously sampling using the "Phase III methodology" and (2) soil samples to identify potential arsenic exposure hazards in residential yards. Phase III investigations will only be performed as part of the pilot study if a property has not been previously sampled using those procedures. Phase III investigation samples will be analyzed for lead and arsenic. Hazard identification sampling will be performed at all properties included in the pilot study. Separate procedures are provided in the Soil Sampling SOP (Attachment A) for collecting these two types of samples.

Before initiating soil sampling to identify potential arsenic-exposure hazards, EPA will review all existing records of measured arsenic levels in yard soils at the property. EPA has already collected grab samples at a number of the properties sampled during the Phase III investigation. If such samples have already been collected, then those results will be used to assist samplers in selecting areas for sampling to support the arsenic-exposure evaluation.

The soil sampling performed to identify exposure hazards will focus on areas of the yard where bare soil is present and readily accessible to young children and has not been previously sampled by EPA. Examples of yard areas where bare soil is likely to be present include the foundation area around the home, play areas, garden areas or pet areas. The arsenic results for soils collected from these targeted bare areas will be used to evaluate potential sources of arsenic exposure for young resident children. The results from the Phase III field investigation will be used to determine the average arsenic concentration in yard soil for comparison to the action level for remediation.

The sampling methods used at properties where an arsenic investigation is performed are designed to provide data comparable to those used to evaluate arsenic health risks in the baseline human health risk assessment (EPA, 2001). For each bare area, a composite sample from the top 2 inches of bare soil will be collected. After drying and sieving to homogenize the soil, the bulk soil sample (less than 2-mm size fraction) will be analyzed for arsenic. A detailed description of the hazard investigation soil-sampling procedure for arsenic is included in the Soil Sampling SOP (Attachment A).

All surface soil samples will be shipped to an offsite laboratory for analyses of arsenic. Soil analyses for arsenic will be performed in accordance with EPA's SW-846 Method 6010B, ICP analysis. For each composite sample, the entire sample volume submitted will be disaggregated, dried and sieved by the laboratory to homogenize prior to analysis. The less than 2-mm size fraction (passing 10-mesh sieve) will be used for analysis. Both Phase III and hazard-investigation samples will be digested prior to ICP analysis using EPA's Method 3052 (microwave-assisted acid digestion using hydrofluoric acid). Quality control methods for laboratory analyses of soil samples are provided in the QAPP (Attachment C).

2.5.2 Focused Dust Sampling

At properties where pressure-treated wood has been used to construct decks, outdoor furnishings or play equipment used by young children, dust wipe samples will be collected from the wood surface to identify wood surfaces that may contribute to children's arsenic exposure. The dust wipes will be collected using procedures identical to those used to collect the indoor dust wipe samples for lead analysis (Wipe Dust Sampling SOP, Attachment A). Dust wipes collected from outdoor wood surfaces will be submitted for analysis of arsenic using AA methods (EPA Method 7060 or 7061A) in accordance with the QAPP (Attachment C). The exact sample location will be described and recorded in field notes.

3.0 COORDINATION WITH PUBLIC HEALTH AND HOUSING AGENCIES

Implementation of the pilot study requires coordination with a number of existing public health and housing agencies currently serving the community within the VB/I-70 site.

3.1 CDPHE and University of Colorado Health Sciences Center

Test results from the KAP health survey performed by the CDPHE and UCHSC during the summer of 2002 will be used to identify resident families with a child (or children) having an elevated blood lead or urinary arsenic level. The UCHSC will notify EPA of families who have agreed to participate in the pilot study. Once families have agreed to participate in the pilot study, EPA will request that they release their screening test results for use in the pilot study. If authorized by the participating family, EPA will then request release of test results from the UCHSC.

3.2 City and County of Denver Department of Environmental Health

The KAP health survey will identify children with blood lead levels greater than 10 μg/dL and report that information to DDEH. Currently, DDEH responds to cases of two reported blood lead levels ≥ 15 μg/ or one reported blood lead level ≥ 20 μg/dL by performing a follow up visit with the family at their home. The home visit includes environmental testing and inspection of the property and a family interview; DDEH also provides ongoing case management and follow up visits as necessary to address health risks from lead exposure. If lead-based paint hazards are identified during the home visit, then DDEH also notifies the NDHC of the site conditions and child blood lead levels so that the Housing Center is aware of the hazard and can offer their services to the family in removing lead hazards from the home.

Because the pilot study includes families with children blood lead levels ≥ 10 μg/dL, EPA will coordinate the pilot-study environmental investigation and the family interview with DDEH to prevent redundancy. DDEH will have the opportunity to accompany the EPA investigators on any home visit for the pilot study and may elect to also conduct a home inspection and interview either independent of or in conjunction with the EPA pilot study. The exact roles of EPA and DDEH will be agreed upon on a case-by-case basis before the home visit is scheduled.

To facilitate this level of cooperation, EPA will notify DDEH of each family that agrees to participate in the pilot study within two working days of receiving the signed access agreement. DDEH

shall contact the EPA project manager if they intend to also perform a home visit or to accompany the EPA representatives when they make their home visit. Home visits will then be scheduled by EPA to accommodate DDEH's schedule and participation at the properties where they intend to complete a home visit or participate in the home visit performed as part of the pilot study.

EPA will provide DDEH with the results for environmental testing at all of the residences visited as environmental investigations are completed. DDEH will receive the same summary data report as the residents (see Section 4) and also copies of the interview questionnaires and field notes made during the home visit.

3.3 Northeast Denver Housing Center

The NDHC has HUD funding available to assist property owners in addressing lead-based paint hazards and also funds available through the Healthy Homes program to address other chemical risks identified at residential properties in Denver. EPA has agreed to provide NDHC with the results from the pilot study's environmental investigation for lead. NDHC may elect to use these data to assist in determining whether health hazards from lead-based paint are present, or other sources, and developing appropriate response actions to protect young children. Results from arsenic analyses of yard soil and any dust wipe samples will also be provided to NDHC for use by their Healthy Homes program.

EPA will provide NDHC with the results for environmental testing at all of the residences visited as environmental investigations are completed. NDHC will receive the same summary data report as the residents (see Section 4) and also copies of the interview questionnaires and field notes made during the home visit.

4.0 DATA MANAGEMENT, DOCUMENTATION AND REPORTING

Detailed records of environmental testing data and family interview responses will be maintained for each property/family participating in the pilot study. Data management and documentation will begin at the home visit but will also entail addition of laboratory analysis results and compilation of data into property-specific reports for each participating family. Requirements for on-site documentation of environmental testing results are included in the SOPs for each testing or sampling procedure (Attachment A). The following section describes the other data management steps that will be followed to produce property reports and a final Technical Memorandum for the pilot study.

4.1 Property Data Management and Reporting

Data collected at each of the participating properties will be recorded on field data forms but also entered into a central electronic database. Property-specific information will be tracked using a unique identification number assigned to each family and each property included in the pilot study. All hard-copy records for an individual property will be maintained in a single file, cross referenced by the property identification number. Those records shall include: signed access and release forms, field forms and data sheets, field notes and maps, family interview questionnaire, laboratory analysis results, data quality review results, and released blood lead or urine arsenic data for children residing at the property, if provided by the resident.

The pilot study's electronic database will include the identification number for each participating property and for each family participating in the pilot study. The pilot study will use these identification numbers to track field, laboratory and interview records. In addition, all reports generated by the pilot study will also use these identification numbers when referring to participants. The database will contain links from the unique identifiers to the real property address and children's and family names, but those names will not be included in the study reports.

The electronic database will include all data collected by the field staff at individual properties as well as the subject child's blood lead and/or urine arsenic levels, if such data are released for use by EPA. Some of the interview responses, such as duration of residence at current address and age of child, will also be incorporated into the electronic database. The interview information that is included will be maintained in the property-specific hard-copy file, along with all other hard-copy data reports for that property.

For each of the participating properties, a final report will be generated from the electronic database to summarize the environmental testing results. That report will describe the results for each type of testing performed in and around the home. For example, all lead and/or arsenic data for soil samples collected on the property will be reported along with descriptions of the sample locations. If possible, the result report will be presented in person to a family representative in order to provide a property-specific explanation of the results. If appropriate, EPA will recommend that the family contact either the NDHC or DDEH for follow-up services and will provide names and phone numbers for contacts at both of these agencies.

4.2 Technical Memorandum

At the completion of the pilot study, a Technical Memorandum will be prepared to document all study activities and provide a summary report of the study's findings. The Technical Memorandum will include:

- Environmental testing results for individual properties (individual property reports);
- Summary description of numbers and types of properties participating in pilot study;
- Summary data for each media type sampled, for all properties sampled;
- Case-by-case narrative description of environmental investigation results and interview responses for each of the participating properties/families to evaluate potential sources of lead and/or arsenic exposure; and
- Laboratory reports for sample analyses and an evaluation to describe data quality.

The report shall not disclose the names or addresses of participating families and properties. That information is considered confidential and cannot be released through the Technical Memorandum.

5.0 SCHEDULE

The pilot study's environmental investigations will begin as soon as recruited families grant access and will continue until all of the participating properties have been completed. Environmental investigations can begin as soon as access agreements have been signed, and it will not be necessary to have a complete list of participating properties or all access agreements in place in order to begin investigations at individual properties. The environmental investigations are anticipated to take approximately six weeks to complete, but the actual duration of the environmental investigation component of the study will depend on the time required to recruit participants and obtain access. Data compilation, management and reporting will be ongoing as environmental investigations are performed and laboratory results reported.

Property testing results will be reported to DDEH and NDHC on an ongoing basis and within 2 weeks of receipt of all sample results by EPA. DDEH will provide data reports to families with elevated blood lead children and EPA will provide data reports to families with elevated urinary arsenic children, also on an ongoing basis as results are received from laboratories and finalized via a quality assurance review.

A draft Technical Memorandum will be completed within 6 weeks of receiving laboratory and field-testing results for all of the participating properties and submitted to EPA for review and comment. The final Technical Memorandum will be completed within 2 weeks of receiving comments from EPA.

6.0 REFERENCES

Washington Group, 2001. Remedial Investigation Report, Vasquez Boulevard/I-70 Site Operable Unit 1. Prepared for U.S. Environmental Protection Agency, Region 8, Denver, CO.

U.S. HUD, 1995, rev. 1997. Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, June 1995

U.S. EPA, Region VIII. 2001. Baseline Human Health Risk Assessment Vasquez Boulevard and I-70 Superfund Site. Denver, CO.

U.S. EPA, 1999. Project Plan for the Vasquez Boulevard and I-70 Site Denver Colorado Phase III Field Investigation. Prepared by ISSI Consulting Group, Inc.

U.S. EPA, 1995. Residential Sampling for Lead: Protocols for Dust and Soil Sampling. EPA 747/5-95-001, March 1995.

Attachment A
Standard Operating Procedures for Environmental Testing

TECHNICAL STANDARD OPERATING PROCEDURE

Date: September 6, 2002 SOP No. MFG-VBI70-01

Title: **Soil Sampling**

APPROVALS:

MFG, Inc.

Author: _____ Date: _____

SYNOPSIS: Provides procedures and instructions for the location and collection of soil samples for laboratory analysis.

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Region 8	Bonnie Lamb / RPM	9/11/02
MFG, Inc.		9/11/02

REV.	DATE	REVISION DESCRIPTION
1	8/16/02	Clarification of sample preparation procedures. Phase III - change to bulk sample analysis with grinding prior to analysis. Hazard Identification for lead – add drying and sieving to bulk fraction prior to analysis.

VASQUEZ BOULEVARD & INTERSTATE 70 SITE COMMUNITY HEALTH PROGRAM PILOT STUDY

STANDARD OPERATING PROCEDURE FOR RESIDENTIAL SOIL SAMPLING

1.0 PURPOSE AND SCOPE

These procedures apply to investigation soil sampling performed at the Vasquez Boulevard and Interstate 70 (VB/I-70) Superfund Site during the community health program pilot study. The soil samples will be collected for analysis of lead and arsenic.

2.0 TRAINING AND QUALIFICATIONS

All personnel performing these procedures will be trained in their use, have significant relevant sampling experience, as approved by the MFG project manager, and be experienced in sample handling, documentation and shipping. Personnel implementing the "Hazard Identification, Lead Investigation Sampling" procedure (Section 4.2.1 below) must also have current certification from the Colorado Department of Public Health and Environment's Air Quality Control Division as a lead-based paint risk assessor.

3.0 EQUIPMENT AND SUPPLIES

- Soil augers/coring tools – Various models of soil augers are acceptable and selection of the specific brand and make of tool will be recommended by the contractor implementing the field work. Augers are usually made of stainless steel, and should be capable of retrieving a cylindrical plug of soil 2 inches in diameter and 2 inches long. In all cases the procedures recommended by the manufacturers should be followed with regard to use of the auger. Augers with disposable plastic sleeves may be employed to minimize the decontamination effort.

- Collection containers – plastic zip-lock bags

- Trowels – for extruding the soil from the auger. May be plastic or stainless steel.

- Composting Bowl – for collecting the grab samples for compositing. Samples will be coarsely mixed in this bowl. May be plastic or stainless steel.

- Gloves – for personal protection and to prevent cross-contamination of samples. May be plastic or latex. Disposable, powderless.

- Field clothing and Personal Protective Equipment – as specified in the Health and Safety Plan.

- Sampling flags – three different colors or numbers. Used for identifying yard soil sampling locations. Each color or number represents a different composite sample.

- Wipes – disposable, paper or baby wipes. Used to clean and decontaminate marker flags.

- Field notebook – a bound book used to record progress of sampling effort and record any problems and field observations during sampling.

- Three-ring binder book – to store necessary forms used to record and track samples collected at the VB/I-70 site. Binders will contain the Surface Soil Data Sheet, Site Diagram, and sample labels for each day. Example forms are provided in Attachment 1.

- Permanent marking pen – used as needed during sampling and for documentation of field logbooks and data sheets.

- Measuring tape or wheel – used to measure each property.

- Measuring tape or pocket ruler – used to measure the length of soil core in the soil coring device.

- Water Sample Bottle, preserved with Nitric Acid – used to collect equipment rinsate QC samples each day.

- Trash Bag – used to dispose of gloves and wipes.

4.0 SAMPLE TYPES AND SAMPLING PATTERNS

This procedure may be used to collect two types of soil samples: (1) Phase III Field Investigation (EPA, 1999) soil samples at residential properties, schools, day-care facilities and parks and (2) soil samples to identify hazards in soil at residential properties in accordance with guidance from the U.S. Department of Housing and Urban Development (HUD) (HUD, 1995). Phase III investigation samples will be analyzed for lead and arsenic; hazard investigation samples will be analyzed for either lead or arsenic, depending on the type of investigation being performed.

Phase III investigations will only be performed as part of the pilot study if a property has not been previously sampled using those procedures. Sampling for hazard identification will be performed at all properties included in the pilot study. Separate procedures are provided below for collecting these two types of samples.

4.1 PHASE III SOIL INVESTIGATION

The sampling pattern and sampling methods described in this section were originally developed by EPA for their Phase III Field Investigation (EPA, 1999) and are consistent with those used during the Phase III work.

The sampling patterns for residential yard, school or park soils are designed to identify and collect samples to support human health risk assessment. Idealized sampling patterns for residential soils are presented in the attached figures, but possible deviations from these sampling patterns could occur based on buildings or other obstructions found at each property. However, sample locations will be identified on a property-by-property basis.

4.1.1 RESIDENTIAL YARD SOIL

Residential yard soil samples will be composited, which requires soil collection from multiple (sub-sample) points. These soils are then mixed and used as a measure of the concentration averaged over the entire area (property). Surficial yard soil samples (0-2 inch depth) will be collected.

Soil Sample Location Identification

The surficial sampling locations within a yard will be based on a 30-point sampling grid. Because of the large number of properties that require sampling during this project, an independent chemical analysis will not be performed for each of the sub-samples collected from

each property. Rather, at least three composite samples will be collected per residence, each consisting of 10-sub-samples that are identified by marker flags of the same color or number. Although numbers may be used for identification of sample locations, for the purposes of this SOP, all procedural descriptions will be illustrated using colored marker flags, (e.g., 10 red, 10 blue, and 10 yellow). The number of total sample points may be reduced from 30 to 15 (three 5-point composites) at properties with very limited sample area, for example, the sample points would result in points being less than five feet apart (total sample area is less than 750 square feet). Identification of individual grab sample locations will be performed using the following general steps.

The sampling technician will be trained in this procedure in order to ensure replicable sample location assignment. The following steps will be followed (in order) prior to any sample collection:

a. Measure each yard
b. Pace off each building or permanent obstruction
c. Identify major sampleable areas
d. Determine the number of sample points in each sub area
e. Record sample locations
f. Mark sample locations
g. Collect the sample

Measure each yard

The sampling technician will measure the property dimensions with a measuring tape, measuring wheel or laser measuring device (± 0.5 feet). Draw a sketch of the property and record property dimensions, north orientation, and adjacent streets and alleyways on the site diagram.

Pace off each building or permanent obstruction

The sampling technician will then pace off the major permanent structures of the residence (e.g., dimensions of the property boundary, house garage, driveway, etc.) and prepare a site diagram to approximate scale ± 3 feet on each measurement). The goal is not have a drawing to scale, but instead to have an estimate of the total sampleable area in the residential yard. The total sampleable area is defined as any area on the property that is free of permanent obstructions. Temporary obstructions such as automobiles or trailers parked on unpaved property locations, picnic tables, plastic or other materials covering the property are not permanent structures and will be considered "sampleable." Therefore, areas that could be used in the future if the temporary obstructions were removed, should be identified on the field diagram and must be considered in sample location identification. Figure 2 and Figure 3 provide examples of a typical residence at the VB/I-70 site that has been drawn on a grid.

Identify major sampleable areas

For each residence, the sampleable area will be divided into rectangular sub areas, using natural boundaries such as the house, garage, sidewalk or gardens as division markers (See Figure 3). A minimum of three and a maximum of eight sub areas will be identified to the nearest pace (± 3 feet). For convenience, it is recommended that the number of sub areas identified is minimized. Draw the sub areas on the site diagram sheet. Count the number of squares in each sub area and record this information on the field data sheet.

Determine the number of sample points in each sub area

Add the total number of squares contained in each of the sub areas, and record in the appropriate space on the surface soil data sheet. Divide this number by 30 to determine the grid area per sample point, and record in the appropriate space on the data sheet (Attachment 1). To determine the number of sample points in each sub area, divide the number of squares in each sub area by the grid area per sample point. Using standard analytical rounding procedures, round each number to the nearest whole number to determine the number of sample points in each sub area. (See Figure 3 for example). The number of total sample points may be reduced from 30 to 15 (three 5-point composites) at properties with very limited sample area, for example, the sample points would result in points being less than five feet apart (total sample area is less than 750 square feet).

Record sample locations

Before placing flags into the yard, mark their planned location on the site diagram. Marking flag locations on the site diagram before actually placing them will give the sampling technician a chance to check that sample locations are evenly distributed within each sub area, and that all sub-sample locations are documented and recorded. In addition, if an error has occurred in the calculation of sub-sample locations, it will be discovered before any flags have been staked. Because property sizes and obstacles present at each residence may vary significantly, actual sample locations will be identified using a diagram that will be drawn for each individual property sampled. If either permanent obstructions, temporary obstructions, or bare areas are present at the intended sampling locations (e.g., sidewalk, shed, garden, etc.), the sample point should be offset so that a surficial yard soil may be collected, then the actual sample location must be correctly documented on the field diagram. If the sampling technician identifies an error in the sample location identification procedures that compromise the readability of the document, a new, revised diagram may be necessary. After recording all of the sample points, the sampling technician should check the site diagram to make sure that sub-sample locations are not clustered in any area (unless clustering is a result of offsetting sample locations due to

obstructions). The sampling technician should also verify that sample points are approximately equidistant throughout the property.

Mark sample locations

Starting at one corner of the property, stake sub-sample locations using a repeated sequence of three distinct flag types (i.e., Yellow, Blue, Red, Yellow, Blue, Red, etc.) in alternating sequence across sub areas. Do not place the same flag types next to each other, so that there is an even distribution of flags in each sub area (Figure 3). As seen in Figure 3, the location of each marker flag should be approximately equidistant from the other flags within each subsection. Additionally, each color flag should be alternately placed so that the same color marker flags are not clustered. A sample location or flag may be reassigned if clustering is observed.

Surface Soil Collection

The first composite will be collected by combining the samples at flags of similar color (e.g. red). Grab samples will be collected from the 0-2 inch soil horizon adjacent to each marker flag. Each sample will be collected using a clean coring tool (2-inch diameter). Grab samples marked by a red flag will be placed into a stainless steel bowl and homogenized (see Section 4.1.3). The homogenized composite sample will be placed into a single zip-lock bag and labeled in accord with the Sample Handling SOP. The second and third composite samples will be collected in identical fashion but by sampling next to the blue and yellow flags, respectively.

4.1.2 SCHOOLS AND PARK SOIL

Surface soil samples at schools and parks will be collected using the same sampling strategy as discussed for the residential soil sampling (Section 4.1.1). The number of grab samples collected at an individual school or park may vary, but 3 composite samples will be collected at minimum. Each individual grab sample will be identified using marker flags on any three different colors (e.g., red, blue, and yellow). The exact sampling pattern will be unique to the individual school or park and will be documented thoroughly in the sampling technician's field records. At minimum, each marker flag will be approximately equidistant from the other flags and each color flag should be alternately placed so that the same color marker flags are not clustered.

4.1.3 COLLECTION OF COMPOSITE SAMPLES USING A CORING TOOL

Locate the sub-sample point as specified by the sampling technician and clean the area free of twigs, leaves, and other vegetative material that can be easily be removed by hand. If the specified sub-sample point is occupied by a rock, cobble or other hard object of sufficient size to be incapable of easy removal by hand, move the sub-sample point to a location closest to the original point.

Place the coring tool on the ground and position it vertically. Holding the tool handle with both hands, apply pressure sufficient to drive the tool approximately two inches into the ground while applying a slight twisting force to the coring tool. Remove the tool by pulling up on the handle while simultaneously applying a twisting force. If the sample was retrieved successfully, a plug of soil approximately two inches long should have been removed with the coring tool. If turf-like vegetation (lawn) is present at the sample location, the sod will be cut and removed prior to advancing the coring tool. The coring tool will then be driven into the newly exposed soil to the measured two-inch interval as marked on the outside of the auger.

Hold the coring tool horizontally or place it on the ground. Using a clean spatula or knife, remove the soil collected at depth greater than two inches from the end of the sampling tool. Excess soil material will be replaced at the sampling point. Use a trowel to extrude the soil from the auger, pushing the two-inch soil plug from the coring tool so that it falls directly into the stainless steel compositing bowl. If sod material was removed, scrape the loose soil from the turf plug and allow it to fall into the compositing bowl. Repeat the steps outlined above until all of the sub-samples for a composite have been collected and homogenized in the compositing bowl. After homogenization the sample will be transferred to a large zip-lock bag. Repeat the steps outlined above for collection of the second and third composite samples.

All samples will undergo further sample preparation homogenization by the analytical laboratory prior to performing analyses in accordance with Phase III SOP titled "Sample Preparation" (MK-VBI70-05). Samples will be dried and sieved (<2 mm, 10 mesh sieve) by the laboratory prior to analysis.

If sampling equipment is to be re-used, follow the decontamination procedures outlined in Section 9.0 before collecting the next composite sample. There is no need to decontaminate between locations for subsamples collected for a single composite sample.

4.2 HAZARD IDENTIFICATION

Soil samples will be collected from targeted areas that represent increased risk of children's exposure to soils. For the purposes of this pilot study, such areas include any play

areas, driplines or building foundations, pet areas, gardens or flowerbeds where bare soil is present. Each distinct bare area with dimensions of at least 9-square feet will be sampled. If there is no bare soil present, then no sampling shall be necessary. However, in most cases, there will be at least small bare areas across the yard that should be sampled.

Use the sampling procedure appropriate to the type of hazard investigation being performed. For properties being investigated for the presence of lead hazards, use the lead investigation procedure (Section 4.2.1). For properties being investigated for the presence of arsenic, use the arsenic investigation procedure.

4.2.1 Lead Investigation Samples

The procedures for soil sampling at properties where lead hazards may be present, is the same as the procedure recommended by the U.S. Department of Housing and Urban Development (HUD) for performing lead-based paint investigations at residential properties where children with elevated blood lead levels reside (HUD, 1995). Sampler will refer to HUD guidelines for soil sampling for additional details regarding soil sampling for lead (Appendix 13.3, HUD, 1995).

For each target bare area, a single composite sample will be obtained by combining a minimum of three sub-samples. Samples will be collected using a coring tool, stainless steel scoop or sampling container to acquire the **top half-inch** of soil. Selection of sampling equipment appropriate to the soil conditions will be at the discretion of the sampling technician.

Each composite sample will include approximately equal mass of soil from each sub-sample collected from 5 to 10 distinct locations roughly equidistant from each other along an axis that covers the target bare area (HUD, 1995). For samples collected along the foundation drip line, sub-samples should be collected at least 2 to 6 feet away from each other. At other sampling locations, samples should be collected at roughly equidistant points along each axis of an "x" shaped grid.

If paint chips are present in the soil, they should be included as part of the soil sample. However, there should be no special attempt to over sample paint chips. If paint chips are large, they may be disaggregated (i.e., broken up) by the sampling technician during homogenization of the composite sample. Although paint chips should not be over sampled, they should also not be excluded from the soil sample, since they are part of the soil matrix that is accessible to children.

The procedures to collect individual subsamples from the target bare areas are as follows:

1. At each subsample location, begin by clearing a circular area approximately 6 inches in diameter of loose debris or sparse vegetation.

2. Using a decontaminated scoop or core sampler remove the soil from the top half inch of the soil profile and contain in a new, resealable plastic bag labeled with the target area description and sample number.

3. Fill resulting hole with loose soil to the ground surface level, tamp down fill to match surrounding surface grade.

These steps will be repeated at each of the subsampling locations for each target bare area sampled. For each target area, the subsamples from each depth interval will be combined into a single plastic bag, sealed, manually disaggregated and labeled. If any large rock fragments or large foreign materials (e.g., paper or plastic trash, nails, etc.) are present, these may be removed before sealing the bag.

The composite soil samples will undergo further homogenization by the analytical laboratory prior to performing analyses. Samples will be dried and then sieved (<2 mm, 10 mesh sieve), and only the <2 mm fraction (bulk soil) will be analyzed for lead.

Decontaminate sampling equipment after completing subsampling within each target bare area. Decontamination procedures are provided in the SOP for Soil Sampling Decontamination.

4.2.2 Arsenic Investigation Samples

The sampling procedure for arsenic investigations is based on the HUD recommendations for lead hazard identification but it provides sample types that are directly comparable to those used in baseline human health risk assessments performed for the Vasquez Boulevard/I-70 Site, and does not include samples around the drip line.

For each target bare area, a single composite sample will be obtained by combining a minimum of three sub-samples. Samples will be collected using a coring tool or stainless steel scoop to acquire the **top 2 inches** of soil. Selection of sampling equipment appropriate to the soil conditions will be at the discretion of the sampling technician.

Each composite sample will include approximately equal mass of soil from each sub-sample collected from 5 to 10 distinct locations roughly equidistant from each other along an axis that covers the target bare area. Samples should be collected at roughly equidistant points along each axis of an "x" shaped grid.

The procedures to collect individual subsamples from the target bare areas are as follows:

1. At each subsample location, begin by clearing a circular area approximately 6 inches in diameter of loose debris or sparse vegetation (if present).

2. Using a decontaminated scoop or coring tool (2-inch diameter and 4-inch length) collect soil from the top 2 inches and contain in a new, resealable plastic bag labeled with the target area description and sample number.

3. Fill resulting hole with loose soil to the ground surface level, tamp down fill to match surrounding surface grade.

These steps will be repeated at each of the subsampling locations for each target bare area sampled. For each target area, the subsamples from each depth interval will be combined into a single plastic bag, sealed, manually disaggregated and labeled. If any large rock fragments or large foreign materials (e.g., paper or plastic trash, nails, etc.) are present, these may be removed before sealing the bag.

The composite soil samples will undergo further homogenization by the analytical laboratory prior to performing analyses for arsenic. Samples will be dried and sieved (<2 mm, 10 mesh sieve), and only the <2 mm fraction (bulk soil) will be analyzed for arsenic.

Decontaminate sampling equipment after completing subsampling within each target bare area. Decontamination procedures are provided in the SOP for Soil Sampling Decontamination.

5.0 SAMPLE CONTAINERS AND LABELING

Following the procedures outlined in Section 4.0, grab samples will be composited and then placed into sample containers (quart-sized plastic zip lock bags or larger). For each composite sample, two sample identification labels are required. One label is placed on the Soil Collection Data Sheet (Attachment 1), the other label is affixed to the quart-sized bag containing the sample. Sample identification will adhere to procedures detailed in the Sample Handling and SOP.

Soil sampling equipment will be thoroughly cleaned after each sampling day and inspected for damage or wear. Worn or unusable equipment will be replaced immediately.

6.0 FIELD QUALITY CONTROL SAMPLES

Equipment rinsates and field duplicates will be collected with investigation soil samples. Equipment rinsates associated with soil samples will be collected by pouring reagent water through the decontaminated re-usable equipment used to obtain soil samples (e.g., soil scoops and mixing bowls). Field duplicate samples will be collected at the same location as the soil samples, and will be splits of the homogenized samples. The duplicate sample will be assigned a separate sample identification number and will be a blind duplicate to the laboratory. One equipment rinsate and one field duplicate will be collected each day of sampling and submitted for laboratory analysis for lead.

7.0 SITE CLEAN-UP

Each hole made in the yard using the coring tool must be backfilled with clean topsoil and tamped down lightly. If sod was removed to obtain the soil sample, the hole should be backfilled and then the grass plug be replaced by the field personnel. Wherever possible, sod and soil (not collected and retained as part of the composite sample) should be replaced in the same hole.

All flags (if reused) should be decontaminated by wiping off with towels and/or baby wipes before re-use.

Throw all used wipes and gloves into the trash bags for off-site disposal.

8.0 RECORD KEEPING AND QUALITY CONTROL

Each field crew will carry a three-ring binder book that contains the surface soil data sheet, site diagram, and sample labels. In addition, a field notebook should be maintained by each individual or team that is collecting samples. At the end of each day, the field crews will finalize and photocopy site sketches and data sheets and place the originals on file in a field office or other secure location. For the Phase III investigation properties, each property must have site sketches with sub areas and grab sample locations needed for the sub-samples. Also note any deviations from the Phase III sampling plan in the field notebook.

For each property, the notebook information must include:

a. Project name
b. Sampling procedure used (SOP section reference)
c. Date

d. Time
e. Personnel
f. Weather conditions
g. Sample identification numbers with time of collection
h. List of sample areas or target areas
i. Locations of composite samples and sub-samples collected
j. Descriptions of any deviations from the sampling plans in this procedure and the reason for the deviation.
k. Signature of the field technician collecting samples and recording sample information

Samples taken from soils with visible staining or other indications for non-homogeneous conditions should also be noted. Field personnel will collect the proper type and quantity of quality control samples as prescribed in Section 6.0 above.

9.0 DECONTAMINATION

All sampling equipment must be decontaminated prior to reuse as prescribed in the Soil Sampling Decontamination SOP.

10.0 EQUIPMENT CALIBRATION AND MAINTENANCE

Soil sampling equipment will be thoroughly cleaned after each sampling day and inspected for damage or wear before storing. Worn or unusable equipment will be replaced immediately.

11.0 GLOSSARY

Sample point – The actual location at which the sample is taken. The dimensions of a sample Point are 2" in diameter and 2" deep (core technique) or 2" across by 2" deep (spoon/scoop technique).

Composite sampling – A sample program in which multiple sub-sample points are compiled together and submitted for analysis as a single sample.

Sample zone – A unit of surface area subjected to a given sample program. A given zone usually is thought to contain similar metals concentrations or to be defined by a single set of exposure parameters.

Targeted area – Those areas identified by the sampling technician as posing an increased risk of exposure due to bare soils lacking dense, year-round vegetation. Typical bare areas include gardens, flowerbeds, bare play areas, bare driplines and bare areas near building foundations.

12.0 REFERENCES

ASTM (American Society for Testing and Materials), 1995. Standard Practice for Field Collection of Soil Samples for Lead Determination by Atomic Spectrometer Techniques, ASTM Designation: E 1727-95, October 1995, 3 p.

EPA (U.S. Environmental Protection Agency), 1999. Project Plan for the Vasquez Boulevard & I-70 Site Phase III Field Investigation. Prepared by ISSI Consulting Group, Inc., August 4, 1999.

EPA, 1995. Residential Sampling for Lead: Protocols for Dust and Soil Sampling, EPA Doc. No. 747-R-95-001, March, 38 p.

HUD (U.S. Department of Housing and Human Services), 1995. Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, Washington, D.C., June 1995.

Surface Soil Data Sheet

Phase: Pilot Study

Medium: Surface Soil

Date: _____

Location: _____ _____ **Property #:**_____
(House #) (Street Name)

Building Type: Residential (circle one): Single Multifamily Apartment

School (name): _____

Park (name): _____

Phase III Samples

Sample Number	Sample Time	Sample Depth
		0-2"
		0-2"
		0-2"

Hazard Screen Samples

Hazard Screen Type: (circle one): Arsenic Lead

Sample Number / Location	Sample Time	Sample Depth

Notes: _____

_____

_____

Samplers' Signatures:

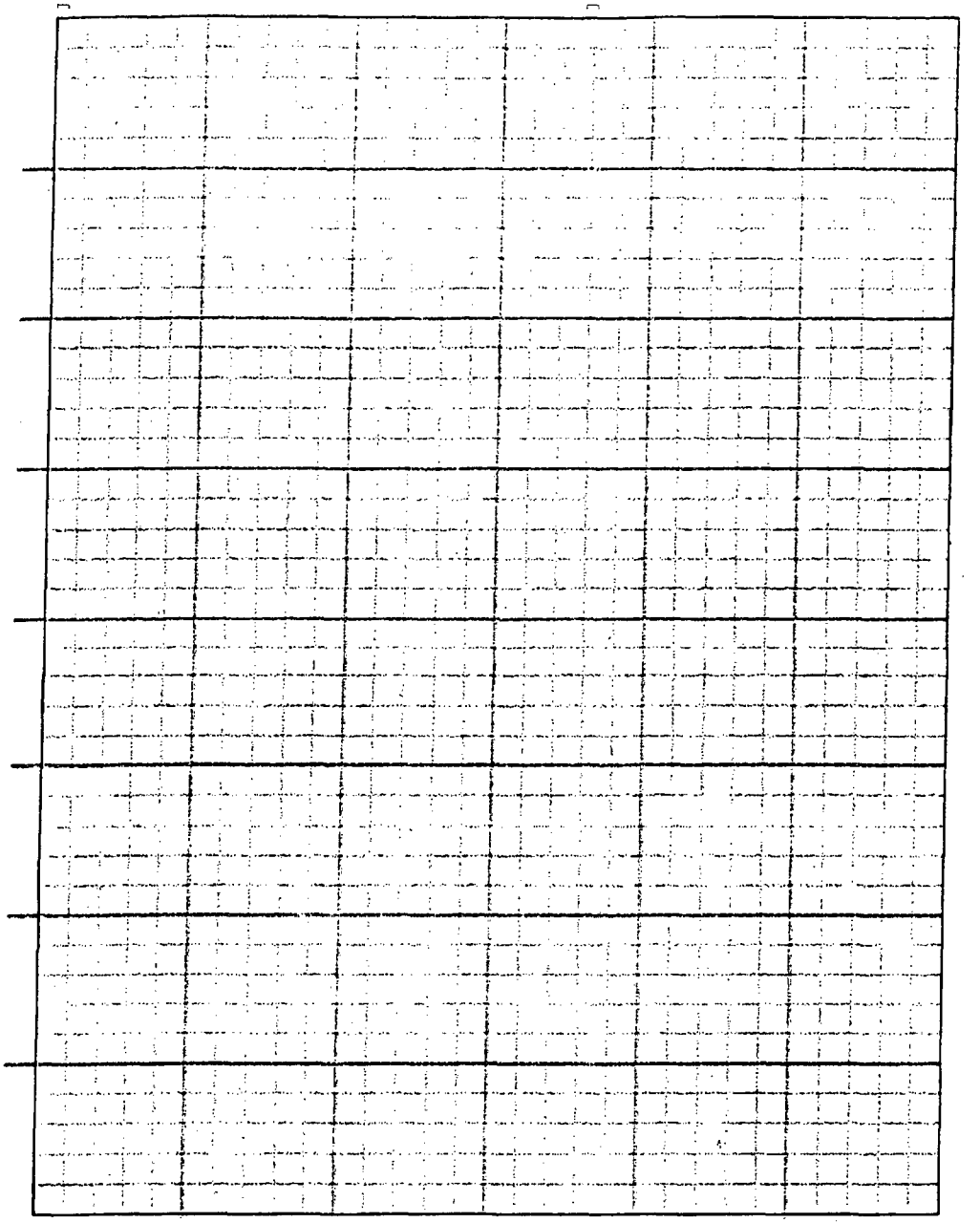
_____ Date: _____

_____ Date: _____

VB/I70 Phase III Soil Sampling
Property Diagram

Property Address: _____ Property Number: _____

North Arrow



Sub Area	No. of Grids	Grid Area per Flag (APF)	No. of Flags in Sub Area (SubArea Grids ÷ APF)
1			
2			
3			
4		(Total Grids ÷ 30)	
5			
6			
7			
8			
Total Grids:			Total Flags (30):

Samplers' Signatures:

_____ Date: _____ _____ Date: _____

TECHNICAL STANDARD OPERATING PROCEDURE

Date: September 6, 2002 SOP No. MFG-VBI70-02

Title: **Paint Sampling**

APPROVALS:

MFG, Inc.

Author: _____ Date: _____

SYNOPSIS: Provides procedures and instructions for the location and analysis of paint samples for in-situ analysis.

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Region 8	Bonnie Lamb / RPM	9/11/02
MFG, Inc.		9/11/02

REV.	DATE	REVISION DESCRIPTION

VASQUEZ BOULEVARD & INTERSTATE 70 SITE
COMMUNITY HEALTH PROGRAM PILOT STUDY

STANDARD OPERATING PROCEDURE FOR
PAINT TESTING AND ASSESSMENT

1.0 PURPOSE AND SCOPE

These procedures apply to investigation paint sampling performed at the Vasquez Boulevard and Interstate 70 (VB/I-70) Superfund Site as part of the community health program pilot study. The procedures may be used for both interior and exterior paint investigations. Methods for in-situ paint testing for lead content and visual evaluation of paint condition are provided.

2.0 TRAINING AND QUALIFICATIONS

Personnel implementing these procedures must be trained, Colorado-certified risk assessors for lead-based paint hazards, in accordance with Colorado's Air Pollution Prevention and Control Act, Regulation 19 – Requirements for Lead-Based Paint Abatement. Personnel operating x-ray fluorescence (XRF) spectrometers to test the lead content of paint must also be trained by the instrument manufacturer in the proper use and maintenance of that equipment.

The risk assessor shall be familiar with the guidelines for paint testing and assessment including in Section 4.1.2 of the work plan before implementing this procedure.

3.0 PROCEDURES

A visual assessment of paint condition throughout the home will be performed followed by paint testing on surfaces where paint is deteriorated in areas selected by the risk assessor. Details regarding the paint-testing plan are provided in the Pilot Study Work Plan, Section 2.4.1.

The first step for evaluation of lead-based paint at any property is the visual assessment, described in Section 3.2 of this procedure. The risk assessor performs the visual assessment and then prepares a plan for paint testing to focus on areas of the home where paint is deteriorated and where children may encounter deteriorated paint on a frequent basis.

The lead content of paint will be tested in situ using a portable XRF instrument. The

instrument will be appropriate for use on painted surfaces and for a range of painted substrates (wood, metal, plastic, etc.). The paint testing method is non-destructive to paint and will not damage painted surfaces or underlying substrates. Procedures for testing paint are detailed in Section 3.3.

3.1 Equipment

A portable XRF spectrometer will be used to test paint for lead content. Equipment specifications are listed below:

- Niton XL-300 or –700 Series Spectrum Analyzer: a field portable XRF spectrometer to process signals from which elemental concentrations in a sample may be calculated (refer to Attachment C for Performance Characteristic Sheet).
- Sealed cadmium (Cd)-109 source

Other equipment needed to follow this procedure include:

- Site plan of property including structures on property, exterior walls and interior rooms of the main residence.
- Field forms - Paint Testing and Assessment Worksheet, Evaluation of Paint Condition, Diagram of Property Interior, Diagram of Property Exterior (Attachment A)
- Clipboard

3.2 Visual Inspection Procedures

A visual assessment is conducted throughout the house. The State-certified risk assessor will inspect painted surfaces and the dust reservoirs in each room. Paint conditions will be inspected in living areas. Areas such as attics, crawl spaces, cellars or other locations that are inaccessible to young children will not be inspected. When assessing the paint the risk assessor will note the condition of the paint, identify friction or impact surfaces and determine whether painted surfaces show evidence of chew marks.

3.2.1 Condition of Painted Surfaces

When evaluating the condition of the paint the risk assessor will rate the paint condition

as "good," "fair," or "poor." Fair and poor condition surfaces are indicators of deteriorated paint and considered to be a potential source of lead exposure, or a lead hazard. Intact paint or "good" condition surfaces should be monitored for signs of deterioration. The following is based on the HUD guidelines.

Categories of Paint Film Quality

Type of Building Component[1]	Good	Fair[2]	Poor[2]
Exterior components with large surface areas	Entire surface is intact	<10 sq feet are deteriorated	>10 sq feet are deteriorated
Interior components with large surface areas (walls, ceilings, floors, doors)	Entire surface is intact	<2 sq feet are deteriorated	>2 sq feet are deteriorated
Interior and exterior components with small surface areas (window sills, baseboards, soffits, trim)	Entire surface is intact	<10 percent is deteriorated	>10 percent is deteriorated

[1] A building component refers to each *individual* component or side of building, *not* the combined surface area of all similar components in a room (e.g., a wall with 1 square foot of deteriorated paint is in "fair" condition, even if the other three walls in a room are intact).

[2] Surfaces with deteriorated lead-based paint (in "fair" or "poor" condition) are considered to be lead-based paint hazards and should be addressed through abatement or interim controls.

The risk assessor will use professional judgment when evaluating the condition of painted surfaces but will follow HUD's assessment guidelines and use their definitions for good, fair, and poor paint conditions. The size of an area of deteriorated paint need not be measured but simply estimated.

Paint conditions can be grouped into three general categories: surface deterioration, bulk deterioration, and layered deterioration (NDPA, 1990).

3.2.1.1 Surface Deterioration

Chalking fine powder on the surface of a paint film usually caused by inadequate priming or sealing, over-thinning of paint or exposure to sunlight. Almost all exterior oil paints are designed to eventually chalk in order to wash dirt away in the rain and provide a good surface for repainting. When paint is lead based, the chalk may contain high levels of lead.

Mildew microbial growth usually caused by excessive moisture. If unchecked, mildew

formation can lead to extensive paint film failure. Mildew should be removed to decrease the chance of paint film deterioration.

Worn Paint worn or chipped due to friction or mechanical damage. Worn paint is often due to improperly hung doors, sticky window sashes, etc. The building component should be repaired so that it operates smoothly before it is recoated.

3.2.1.2 Bulk Deterioration

Checking short, narrow breaks in the top layer of paint, usually caused by a loss of elasticity. Plywood substrates can often cause checking. The deteriorated paint should be removed if a new coating is to be applied.

Cracking and Flaking advanced checking that usually occurs on surfaces with multiple layers of paint, including breaks that extend to the base substrate. The cracks usually form parallel to the grain of the wood. The damaged coating should be removed if a new coating is to be applied.

Alligatoring reptilian scale patterns that are often caused by inadequate bond between the topcoat and underlying coats from paint films that are too thick, or the application of a brittle coating over a more flexible one. The old paint should be completely removed and the surface should be primed and repainted. Enclosure or component replacement will probably be the most effective and safe hazard control methods in this circumstance.

3.2.1.3 Layered Deterioration

Blistering bubbles in the paint film caused by either heat or moisture. If bare substrate shows beneath the blister, then the likely cause is moisture. However, if another layer of paint shows instead of substrate, heat probably caused the blister. The risk assessor should endeavor to locate the moisture source if moisture is suspected. Control of the moisture source will lengthen the effective life span of many forms of lead-based paint hazard control, especially paint film stabilization.

Scaling or Flaking (peeling) paint separation often found in those exterior areas of the building susceptible to condensation, such as under eaves. Salt deposits drawn to the paint film surface can cause scaling. The deteriorated paint should be removed, and the salts should be washed off if the surface is to be recoated. Enclosure may be the most effective and safe hazard control method for this type of deterioration.

Peeling from Metal paint separation usually caused by improper priming of bare, galvanized metal, or by rusting. The loose paint should be removed by wet scraping and the metal should be primed with a galvanizing primer or other primer made for metal before paint film stabilization. Industrial paints containing lead should not be used to prime metal surfaces. Component replacement and enclosure are likely to be most effective.

Peeling From Exterior Wood paint separation usually resulting from wet wood swelling under paint, causing the paint film to loosen, crack, and dislodge. Moisture may come from the interior of the house (poor ventilation) or from exterior moisture penetrating the paint film. The risk assessor should recommend that the cause of the moisture problem be addressed before attempting paint film stabilization or any form of recoating.

Peeling From Plaster Walls paint separation from insufficient wet troweling of the white coat when the plaster was applied, causing chalking of the surface. Both the use of glue size, which absorbs water and use of a primer with poor alkali resistance can also cause deterioration. The remedy for peeling paint is decided on a case-by-case basis.

Peeling From Masonry Surfaces paint separation often caused by the alkaline condition of the surface. A coating system that is appropriate for alkaline surfaces should be used.

3.2.2 Condition of Friction and Impact Surfaces

Paint deterioration on friction and impact surfaces will be determined by operating several of the most frequently used windows and doors within the tested rooms. Windows that jamb and doors that bind or otherwise hit the frame are potential sources of leaded dust. A visual assessment of these areas will be performed and painted surfaces evaluated by rating their condition as good, fair or poor.

3.2.3 Chewed Surfaces

Surfaces with teeth marks are considered hazards if the paint is lead based. All chewed surfaces will be noted, and the paint lead content of all chewed surfaces will also be measured.

3.3 XRF Measurement Procedures

Interior and exterior paint will be analyzed for total lead using a portable XRF. Exterior paint testing will not be performed in rain or snow or on surfaces that are wet. First refer to the paint-testing plans for interior and exterior paint are included in the Pilot Study Work Plan, Section 2.4.1. for instruction on identifying the areas of the home where paint testing will be performed, and then follow the instructions below for testing paint in those areas.

At each test location, an XRF measurement will be collected in the following manner:

1. Place probe on a flat surface of intact paint.
2. Open the shutter via the spring-loaded trigger and analyze the test area for the appropriate count time (e.g., 10-20 seconds or until STD drops to within the acceptable range of ± 0.15 mg/cm^2).
3. Record test result and sample location on the Paint Analysis and Condition sheet.
4. Test results, including spectral analysis, are stored automatically and the screen is cleared to start next measurement.

More detailed information on the use of the Niton XRF is provided in Attachment B, which should be fully understood to prior to use of the instrument for implementing any portion of this SOP.

3.4 Documentation

3.4.1 Visual Assessment

The visual assessment will be documented by the risk assessor using a Paint Testing and Assessment Worksheet and/or Evaluation of Paint Condition form. This form will be completed at each property where an assessment is performed, and the form will be placed in the hard copy property file.

3.4.2 XRF Measurements

For each paint testing location, the risk assessor (or inspector) will record the following XRF measurement data on the Paint Analysis and Condition Form.

- Room or building component location (e.g., main living area or main entry door)
- Direction of the component in room or on building (e.g., east)

- Component being tested (e.g., window)
- Location on the component (e.g., sill)
- Color
- Substrate (e.g., wood)
- Condition of the paint
- Cause for deterioration, if known
- Measured (XRF) lead content in mg/cm^2
- Measurement standard deviation in mg/cm^2

4.0 EQUIPMENT CALIBRATION AND MAINTENANCE

Niton instruments are programmed with automatic calibration procedures and do not require manual calibration at any time. Manufacturer instructions (Attachment B) should be followed to ensure proper data quality assurance. Although calibration is automatic, periodic calibration checks and instrument maintenance should be performed as recommended by Niton for the model used.

4.1 Calibration Verification

Initial calibration is performed automatically when using the Niton XRF Analyzers. Follow manufacturer's instructions (Attachment B) to ensure proper instrument calibration

The correction for source decay, called normalization, is accomplished automatically in the Niton software on a predetermined, timed basis. This assures that the response of the instrument remains constant throughout the life of the source. However, the calibration will also be checked manually in order to ensure proper instrument response.

Instrument performance and calibration verification should be checked using pre-made lead-based paint standards. Standards are available from the National Institute of Standards and Technology (NIST). The NIST standards consist of a set of five mylar sheets that are coated with a single, uniform layer of paint containing lead levels. NIST does not manufacture standards with lead concentrations greater than 3.53 mg/cm^2.

The calibration of the XRF instrument should be checked using the paint film nearest 1.0 mg/cm^2 in the NIST Standard Reference Material (SRM) (e.g., for NIST SRM 2579, use the 1.02 mg/cm^2 film). Measurements should be bracketed by successful XRF calibration check readings.

XRF calibration checks are performed at the beginning and end of the day's inspections or at extended delays in testing, and (at least) every four hours during inspections. If readings are outside the acceptable calibration check range of 0.9-1.2 mg/cm², reanalyze the SRM. If readings continue to be outside of the acceptable range, the instrument must be sent to the manufacturer for troubleshooting. Measurements which are not bracketed by successful calibration checks should be considered suspect.

4.2 Maintenance

The instrument operator will provide routine maintenance at the end of each day of use. Routine maintenance will include cleaning to remove dust or dirt from the surface analysis probe, recharging and/or replacing batteries, and inspecting for damage to working components of the instrument or instrument casing. If any problems are identified through routine inspection, these problems will be reported to the manufacturer and the manufacturer's instructions for addressing those problems will be followed prior to further use of the instrument. The instrument operator will maintain records describing any repair or maintenance activities.

The XRF instrument will require annual maintenance. The instrument will be shipped to the manufacturer, according to their instructions, for routine cleaning, servicing and, if necessary, source replacement.

5.0 QUALITY ASSURANCE/QUALITY CONTROL OBJECTIVES

All lead-based paint testing will be performed in the field with the XL-300 or –700 series spectrometer manufactured by Niton, Inc. Precision for this instrument has been demonstrated to be better than 0.3 mg/cm^2 lead in the range of 0 to 1 mg/cm^2 (refer to Attachment C).

Precision for in situ paint analyses will be checked by collecting triplicate measurements of a sample paint surface at least once per property. Whenever possible the triplicate reading will be conducted at a location with a concentration level near 1 mg/cm^2. The probe will remain in the same position for all three measurements. Each result will be recorded on the worksheet in the order in which it was made and in relation to the measurements of the routine samples. The standard deviation (STD) of these three measurements must be within +/– 0.15 mg/cm^2. If STD values do not meet these objectives, the surface will be examined for anomalies and the procedure will be performed again. If precision objectives are not met again, a "check-sample" procedure will be performed and the precision measurements will be repeated. If the measurements still do not meet the objective STD, the instrument will be returned to the manufacturer for troubleshooting.

6.0 REFERENCES

Colorado Air Pollution Prevention and Control Act, Regulation 19, Requirements for Lead-Based Paint Activities, 1998.

Niton, 1998. Niton 300 Series & 700 Series User's Guide.

U.S. Department of Housing and Urban Development, 1995 rev. 1997. Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing,

ATTACHMENT A

Field Forms

VB/I-70 Pilot Study

Interior & Sample Location Map

Date: _____ Technician(s): _____

Property No.: _____

Property Address: _____

Notes: _____

_____

_____

Diagram of the Property Interior

VB/I-70 Pilot Study

Paint Testing and Assessment Worksheet

Date: _____ Risk Assessor(s)/Technician(s) _____ _____

Property Address: _____ Property No. _____

Sample No.	Room Location	Direction	Component (door, window, floor, lower trim, wall, cabinet, etc.)	Location (on the component)	Paint Color	Substrate	Paint Condition (good, fair, poor)	If the paint is in poor condition why? (friction, impact, moisture, chew marks)	XRF Assay/ mg/cm^2	Std. Dev mg/cm^2
01										
02										
03										
04										
05										
06										
07										
08										
09										
10										
11										
12										
13										
14										
15										

VB/I-70 Pilot Study

Paint Testing and Assessment Worksheet

Date: _____ Risk Assessor(s)/Technician(s) _____ _____

Property Address: _____ Property No. _____

Sample No.	Room Location	Direction	Component (door, window, floor, lower trim, wall, cabinet, etc.)	Location (on the component)	Paint Color	Substrate	Paint Condition (good, fair, poor)	If the paint is in poor condition why? (friction, impact, moisture, chew marks)	XRF Assay/ mg/cm^2	Std. Dev mg/cm^2
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										

VB/I-70 Pilot Study

Paint Testing and Assessment Worksheet

Date: _____ Risk Assessor(s)/Technician(s) _____ _____

Property Address: _____ Property No. _____

Sample No.	Room Location	Direction	Component (door, window, floor, lower trim, wall, cabinet, etc.)	Location (on the component)	Paint Color	Substrate	Paint Condition (good, fair, poor)	If the paint is in poor condition why? (friction, impact, moisture, chew marks)	XRF Assay/ mg/cm^2	Std. Dev mg/cm^2
31										
32										
33										
34										
35										
36										
37										
38										
39										
40										
41										
42										
43										
44										
45										

VB/I-70 Pilot Study

Paint Testing and Assessment Worksheet

Date: _____ Risk Assessor(s)/Technician(s) _____ _____

Property Address: _____ Property No. _____

Sample No.	Room Location	Direction	Component (door, window, floor, lower trim, wall, cabinet, etc.)	Location (on the component)	Paint Color	Substrate	Paint Condition (good, fair, poor)	If the paint is in poor condition why? (friction, impact, moisture, chew marks)	XRF Assay/ mg/cm^2	Std. Dev mg/cm^2
46										
47										
48										
49										
50										
51										
52										
53										
54										
55										
56										
57										
58										
59										
60										
61										

VB/I-70 Pilot Study

Paint Testing and Assessment Worksheet

Date: _____ Risk Assessor(s)/Technician(s) _____ _____

Property Address: _____ Property No. _____

Sample No.	Room Location	Direction	Component	Location	Paint Color	Substrate	Paint Condition (good, fair, poor)	If the paint is in poor condition why? (friction, impact, moisture, chew marks)	XRF Assay/ mg/cm^2	Std. Dev mg/cm^2
62										
63										
64										
65										
66										
67										
68										
69										
70										
71										
72										
73										
74										
75										
76										

VB/I-70 Pilot Study

Paint Testing and Assessment Worksheet

Date: _____ Risk Assessor(s)/Technician(s) _____ _____

Property Address: _____ Property No. _____

Sample No.	Room Location	Direction	Component	Location	Paint Color	Substrate	Paint Condition (good, fair, poor)	If the paint is in poor condition why? (friction, impact, moisture, chew marks)	XRF Assay/ mg/cm²	Std. Dev mg/cm²

VB/I-70 Pilot Study

Evaluation of Paint Condition - Interior

Date: _____ Risk Assessor(s)/Technician(s) _____ _____

Property Address: _____ Property No. _____

Notes: _____

_____

_____

Location (specify if not listed)	**Building Component**	**Paint Condition** circle all that apply	**If the paint is in poor condition why?** circle all that apply	**Comments** (extent, direction, color)
Main Living Area	Ceilings	good fair poor not present	friction impact moisture chew marks	
	Walls	good fair poor not present	friction impact moisture chew marks	
	Floor	good fair poor not present	friction impact moisture chew marks	
	Windows	good fair poor not present	friction impact moisture chew marks	
	Doors	good fair poor not present	friction impact moisture chew marks	
	Trim	good fair poor not present	friction impact moisture chew marks	
		good fair poor not present	friction impact moisture chew marks	
Kitchen	Ceilings	good fair poor not present	friction impact moisture chew marks	
	Walls	good fair poor not present	friction impact moisture chew marks	
	Floor	good fair poor not present	friction impact moisture chew marks	
	Windows	good fair poor not present	friction impact moisture chew marks	
	Doors	good fair poor not present	friction impact moisture chew marks	
	Cabinets	good fair poor not present	friction impact moisture chew marks	
	Trim	good fair poor not present	friction impact moisture chew marks	
		good fair poor not present	friction impact moisture chew marks	
Bedroom	Ceilings	good fair poor not present	friction impact moisture chew marks	
	Walls	good fair poor not present	friction impact moisture chew marks	
	Floor	good fair poor not present	friction impact moisture chew marks	
	Windows	good fair poor not present	friction impact moisture chew marks	
	Doors	good fair poor not present	friction impact moisture chew marks	
	Trim	good fair poor not present	friction impact moisture chew marks	
		good fair poor not present	friction impact moisture chew marks	
Bedroom	Ceilings	good fair poor not present	friction impact moisture chew marks	
	Walls	good fair poor not present	friction impact moisture chew marks	
	Floor	good fair poor not present	friction impact moisture chew marks	
	Windows	good fair poor not present	friction impact moisture chew marks	
	Doors	good fair poor not present	friction impact moisture chew marks	
	Trim	good fair poor not present	friction impact moisture chew marks	
		good fair poor not present	friction impact moisture chew marks	
Stairway	Treads	good fair poor not present	friction impact moisture chew marks	
	Rise	good fair poor not present	friction impact moisture chew marks	
	Railing	good fair poor not present	friction impact moisture chew marks	
	Lower Trim	good fair poor not present	friction impact moisture chew marks	
		good fair poor not present	friction impact moisture chew marks	

Evaluation of Paint Condition - Interior

Bathroom	Ceilings	good fair poor not present	friction impact moisture chew marks	
	Walls	good fair poor not present	friction impact moisture chew marks	
	Floor	good fair poor not present	friction impact moisture chew marks	
	Windows	good fair poor not present	friction impact moisture chew marks	
	Doors	good fair poor not present	friction impact moisture chew marks	
	Cabinets	good fair poor not present	friction impact moisture chew marks	
	Trim	good fair poor not present	friction impact moisture chew marks	
	Ceilings	good fair poor not present	friction impact moisture chew marks	
	Walls	good fair poor not present	friction impact moisture chew marks	
	Floor	good fair poor not present	friction impact moisture chew marks	
	Windows	good fair poor not present	friction impact moisture chew marks	
	Doors	good fair poor not present	friction impact moisture chew marks	
	Trim	good fair poor not present	friction impact moisture chew marks	
		good fair poor not present	friction impact moisture chew marks	
	Ceilings	good fair poor not present	friction impact moisture chew marks	
	Walls	good fair poor not present	friction impact moisture chew marks	
	Floor	good fair poor not present	friction impact moisture chew marks	
	Windows	good fair poor not present	friction impact moisture chew marks	
	Doors	good fair poor not present	friction impact moisture chew marks	
	Trim	good fair poor not present	friction impact moisture chew marks	
		good fair poor not present	friction impact moisture chew marks	
	Ceilings	good fair poor not present	friction impact moisture chew marks	
	Walls	good fair poor not present	friction impact moisture chew marks	
	Floor	good fair poor not present	friction impact moisture chew marks	
	Windows	good fair poor not present	friction impact moisture chew marks	
	Doors	good fair poor not present	friction impact moisture chew marks	
	Trim	good fair poor not present	friction impact moisture chew marks	
		good fair poor not present	friction impact moisture chew marks	
	Ceilings	good fair poor not present	friction impact moisture chew marks	
	Walls	good fair poor not present	friction impact moisture chew marks	
	Floor	good fair poor not present	friction impact moisture chew marks	
	Windows	good fair poor not present	friction impact moisture chew marks	
	Doors	good fair poor not present	friction impact moisture chew marks	
	Trim	good fair poor not present	friction impact moisture chew marks	
		good fair poor not present	friction impact moisture chew marks	
	Ceilings	good fair poor not present	friction impact moisture chew marks	
	Walls	good fair poor not present	friction impact moisture chew marks	
	Floor	good fair poor not present	friction impact moisture chew marks	
	Windows	good fair poor not present	friction impact moisture chew marks	
	Doors	good fair poor not present	friction impact moisture chew marks	
	Trim	good fair poor not present	friction impact moisture chew marks	
		good fair poor not present	friction impact moisture chew marks	

Paint in poor condition will be tested using an XRF measurement. Not present includes non-painted components or the item is not present at this property.

VB/I-70 Pilot Study

Evaluation of Paint Condition - Exterior

Date: _____ Risk Assessor(s)/Technician(s) _____ _____

Property Address: _____ Property No. _____

Notes: _____

_____

_____

Building Component	Paint Condition circle all that apply	If the paint is in poor condition why? circle all that apply	Comments (extent, direction, color)
Wall (front)	good fair poor	friction impact moisture chew marks	
Wall (left side)	good fair poor	friction impact moisture chew marks	
Wall (back)	good fair poor	friction impact moisture chew marks	
Wall (right side)	good fair poor	friction impact moisture chew marks	
Windows	good fair poor not present	friction impact moisture chew marks	
Doors	good fair poor not present	friction impact moisture chew marks	
Horizontal Trim	good fair poor not present	friction impact moisture chew marks	
Vertical Trim	good fair poor not present	friction impact moisture chew marks	
Porch Floor	good fair poor not present	friction impact moisture chew marks	
Porch Railings	good fair poor not present	friction impact moisture chew marks	
Other Porch Surfaces	good fair poor not present	friction impact moisture chew marks	
Outbuildings	good fair poor not present	friction impact moisture chew marks	
Fence	good fair poor not present	friction impact moisture chew marks	
	good fair poor	friction impact moisture chew marks	
	good fair poor	friction impact moisture chew marks	
	good fair poor	friction impact moisture chew marks	
	good fair poor	friction impact moisture chew marks	
	good fair poor	friction impact moisture chew marks	

Paint in poor condition will be tested using an XRF measurement. Not present includes non-painted components or the item is not present at this property.

ATTACHMENT B

NITON 300 Series & 700 Series User's Guide

NITON

300series & 700series
User's Guide
Version 5.2

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NITON 300*Series* & 700*Series* User's Guide
Produced in the United States of America

Registration: NITON Corporation manufactures the 300*Series* and 700*Series* under the authority of the State of Rhode Island, *License #3A-105-01.* NITON 300*Series* and 700*Series* have been evaluated for safety in *Sealed Source and Device Evaluation Sheet RI-164-D-101-S.*

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Preface

NITON XRF analyzers are the fruit of our long-term dedication to cutting-edge research and development in x-ray fluorescence (XRF) technology. Every NITON XRF offers outstanding performance, unsurpassed value, plus a company that stands behind each instrument with no-charge, life-time software upgrades; a 15-month limited warranty; and a highly-trained, dedicated staff of professionals. Our mission is to serve the needs of our users with state-of-the art instruments: the finest, safest, most economical hand-held XRF analyzers money can buy.

This User's Guide is a detailed instruction and reference manual for NITON **XL-309 (300*Series*)**, 701, 701A, 702, 702A, 703 and 703A (**700*Series***) XRF analyzers. The operation and safety instructions in this User's Guide are complete, including sections on radiation safety, and the proper operation, cleaning, storing and shipping your NITON XRF. This User's Guide is designed to compliment the instrument training that NITON provides to NITON users free of charge. Prior to turning on your NITON analyzer, please carefully review *Chapter 1: Getting Started; Chapter 2: Radiation Safety;* and all other sections of this User's Guide that pertain to the type(s) of testing that you will be doing.

NITON **300*Series*** and **700*Series*** XRF analyzers have been designed and manufactured with radiation safety foremost in mind. If you use your NITON properly, according to the instructions in this User's Guide, you will only be exposed to levels of radiation too low to be detected with an ordinary Geiger counter. For your safety, always follow radiation-safe work practices, and never attempt to open or disassemble your NITON XRF analyzer for any reason. All Service except changing battery packs and exterior cleaning must be performed by NITON Corporation. Do not attempt to make repairs yourself. Any attempt to open the aluminum outer casing of your NITON will void the instrument warranty.

User's Guide Conventions

⚠ Warnings: Provide information on how to safely operate the NITON.

⚠ Cautions: Provide information on how to avoid damaging the NITON.

Notes: Highlight other important information.

Warnings, cautions, and notes are printed in bold type.

Chapter Summaries

Chapter 1: Getting Started

Supplies instructions for unpacking the shipping container. Includes basic operating instructions; an overview of NITON XRF test modes; and supplies instructions for instrument calibration, for taking a reading, for downloading data, and for charging and changing battery packs.

Chapter 2: Radiation safety

Includes an overview of radiation safety, instrument radiation profiles, and guidelines for safe operation of NITON XRF analyzers.

Chapter 3: Analyzing Bulk Samples

For users of **702, 702-A, 703** and **703-A** model analyzers (for multiple elements).
For users of ***300Series*** with optional Lead in Soil Analysis Package (for lead only).

Supplies instructions for rapid, on-site, multi-element detection and analysis of a variety of bulk samples, including soils, house dust, sludges, and liquids.

Chapter 4: Analyzing Thin Samples

For users of **701, 701-A, 703** and **703-A** model analyzers (for multiple elements).

For users of ***300Series*** with optional Dust Wipe Analysis Package (for lead only).

Supplies instructions for rapid, on-site, multi-element detection and analysis of a variety of thin samples, including filters, dust wipes and thin films.

Unpacking Your NITON

1 **Inspect the shipping carton** for signs of damage such as crushed or water damaged packaging. Immediately notify the shipper and NITON Corporation if any damage is noted.

Note: **The radioactive cadmium-109 source is completely sealed and extremely secure.It meets ANSI standard 33232.**

2 **Open the packing carton.** If your NITON Spectrum Analyzer is not packed in its carrying case, please call NITON Corporation immediately at (401) 294-1234

3 **Verify the contents** of the shipping container against the packing list. Please record any discrepancies and notify NITON Corporation.

4 **Open the carrying case and visually inspect the instrument** for damage before removing it from the case. Call the shipper and NITON Corporation if you find any damage to the case or its contents.

5 **Save the shipping carton and all packing materials.** Store them in a safe, dry area. Use when the spectrum analyzer is next shipped.

Operation

NITON **300*Series*** and **700*Series*** Spectrum Analyzers are handheld, portable XRF detectors, designed to make fast, accurate measurements. The **300*Series*** measures concentrations of lead, while **700*Series*** instruments measure concentrations of many different elements simultaneously. NITON instruments measure the precision of each reading, store up to 3,000 readings with complete x-ray spectra, and download data quickly to a PC.

NITON has designed the radioactive source and shielding of our analyzers with one guiding principle in mind: properly used, these will not expose the NITON user to levels of radiation significantly above natural background levels.

Note: **The accuracy and precision of the data you collect with your NITON XRF will largely depend on your familiarity with the instrument and your knowledge of the media you are testing.**

Our free factory training is designed to give you the basic tools to use our instruments. This User Guide supplements our training. You can use it as both a quick reference and a detailed operating manual for any of our XRF analyzers.

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This is your NITON XRF Spectrum Analyzer

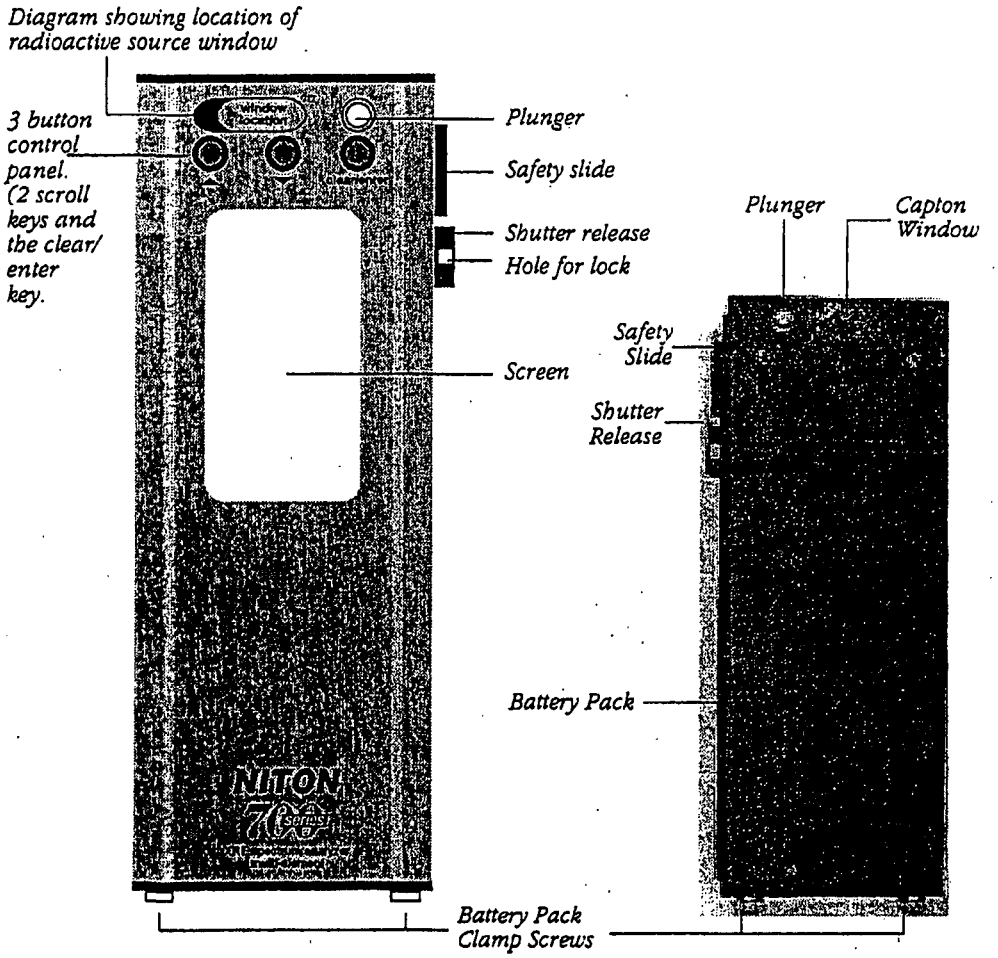


Figure 1.01
Front View of the NITON Spectrum Analyzer

Figure 1.01a
Bottom View of the NITON Spectrum Analyzer

The Control Panel Buttons

The NITON control panel consists of three buttons (**Figure 1.06**). These buttons allow you to navigate all of your NITON's screens and menus. The amount of time you hold down the buttons also controls the function of the buttons. Pressing the Clear/Enter button briefly (less than 1 second) allows you to scroll down through the listed items showing on the screen. Holding down the Clear/Enter button for a longer period (more than 3 seconds) will put you into a different screen.

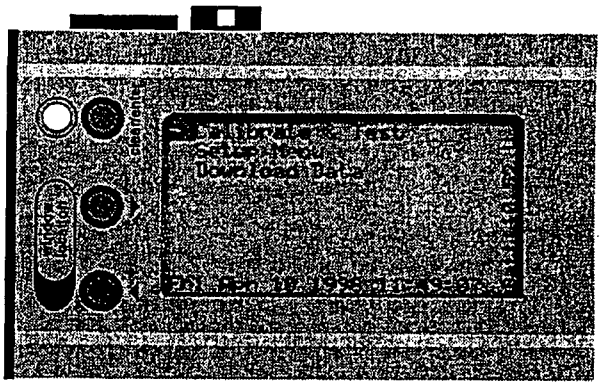


Figure 1.06
The NITON Control Panel

When you turn on your NITON, the Screen arrow will be pointing to **Calibrate & Test (See below)**. Press the **Clear/Enter** button to select the function indicated by the screen arrow.

Note: **You can begin to test immediately in whatever mode you last tested in by pressing the Clear/ Enter button.**

Calibration and Testing

Please read the section "Tips for Better Testing" in the Appendix.

The 300*Series* and 700*Series* Instruments are highly sophisticated, electronic spectrum analyzers. The more familiar you are with your NITON's operation, the better your measurements and reports will be. Here, in brief, is an outline of how to do various kinds of testing using your NITON. More detailed information for each type of testing is offered in subsequent chapters.

1 Turn on the instrument. When testing in Bulk Sample or Thin Sample modes, leave your NITON on for fifteen minutes prior to testing. This is not necessary if you are going to test in any of the Paint Modes.

2 If your NITON is in the mode you want, press Clear/Enter to begin self-calibration. If you want a different mode, go to the Setup Menu (**Figure 1.07**) and set the mode in which you wish to test.

3 When the NITON beeps, calibration is complete. You are now ready to test.

Note: **Before beginning a test, be certain the battery pack has sufficient charge. It is always a good idea to carry a spare battery pack.**

For instructions on how to take a measurement, depending on the nature of the media you will be measuring, turn to one of the following chapters:

Chapter 3: *Analyzing Bulk Samples;*
Chapter 4: *Analyzing Thin Samples; or*
Chapter 5: *Analyzing Lead Paint.*

Note: **Check your instrument's calibration with testing standards NITON has provided before and after testing and at least once per hour during testing. Although the standards do not contain every element our multi-element analyzers test for, when an instrument correctly measures the standards you have received with your NITON, it will correctly measure the other elements. See for more details.**

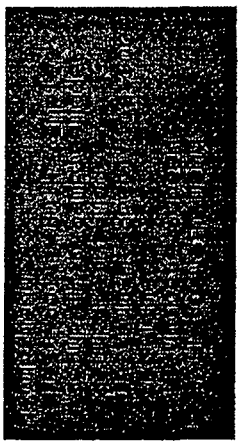


Figure 1.07
The Setup Menu

The Setup Menu (for purposes other than testing)

Use the **Setup Menu** (**Figure 1.07**) to check your instrument specification; to set the date and time; to illuminate the screen continuously; or to select a different testing mode. Once set up, the screen will remain the same each time you turn on your NITON until it is reset. Select the **Setup Menu** from the Main Menu with the Arrow buttons; enter the Setup Menu by pressing **Clear/Enter**.

Checking and Updating Current Information

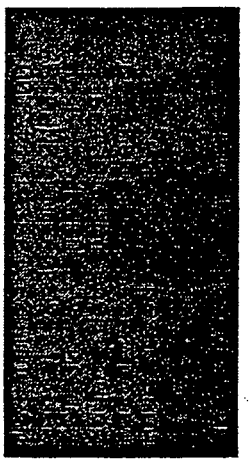


Figure 1.08
Instrument Specification Screen

To check the source strength of your instrument and other useful information (listed below), use the **Arrow buttons** to select the Instrument Specification screen (**Figure 1.08**) from the Setup Menu. Press **Clear/Enter**. The screen will display the following information:

- The **Day, Month, Date, Year** and **Time** (hours, minutes and seconds).
- The **Instrument Serial Number**
- The **Instrument Model** and the versions of **Firmware** and **DSP software** installed on the instrument.
- The **Source Date**, the assay date of the source.

- The **number of days since the last factory calibration** of the instrument.
- The **Hours used**, the number of hours the instrument has been used since the last factory calibration.
- The **Source Strength**, the current strength of the instrument's radioactive sources, in millicuries (mCi).

To exit the Instrument Specification screen to the Main Menu, press the **Clear/Enter** button.

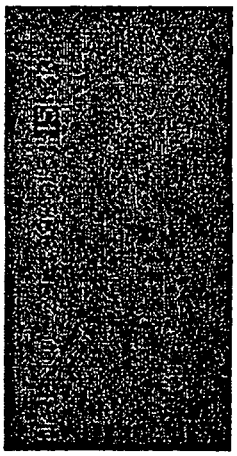


Figure 1.09a
The Setup Menu: Set Time

Setting the Date and Time

NITON sets the date and time (EST) on each instrument before it is shipped. Reset as needed when changing time zones, daylight savings time, or whenever the time or date is wrong.

Caution: Check the Date and Time displayed on the Ready to Test screen. If they are not correct, reset them before taking any measurements. Your readings will not be accurate unless the date and time are correct.

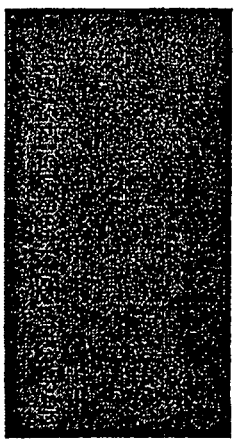


Figure 1.09b
The Setup Menu: Set Date

To reset the date and time from the Setup Menu, do the following steps:

1. Use the Arrow buttons to scroll to **Set Time** (**Figure 1.09 a,b**).
2. Press Clear/Enter to select it. The **Date** and **Time** appear as follows:

   Month—Day—Year—Hour—Minute—Second

Note: **Set the year first. Press Clear/Enter twice to move to the year position and use the Arrow buttons to set the year. Press Clear/Enter five more times to set the remaining fields as described on the next page.**

The cursor will start at **Month** and move to the right each time you press **Clear/Enter.** To change the time and date, move from left to right on the screen. For example, to change the hour and seconds:

1. Press **Clear/Enter** three times to move the cursor to **Hour**.
2. Use the **Arrow buttons** to change the hour shown to the desired hour. Press **Clear/Enter**.
3. The cursor will automatically move to the next field: **Minute**. Use the **Arrow buttons** to change the minutes shown to the desired minutes. Press **Clear/Enter** again to move the cursor to Second.
4. Use the **Arrow buttons** to change the seconds shown to the desired seconds. Press **Clear/Enter**.
5. After selecting **Seconds**, the **Main Menu** screen is again displayed, set to **Calibrate & Test (Figure 109c).**

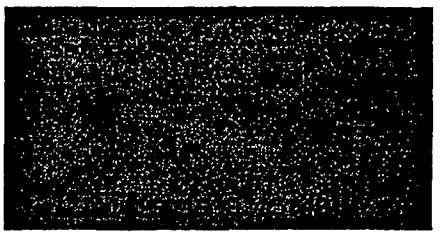


Figure 1.09c
Set Time Screen with corrected settings

Lighting the LCD Screen

Your instrument's LCD screen will remain back-lit for 15 seconds after any of the three buttons are pressed. After 15 seconds, you can light the screen by pressing any of the three buttons. When working in a dark place, you also have the option to light the screen continuously.

To light the screen continuously, or to turn off continuous screen lighting if it is currently activated:

1. Use the **Arrow buttons** to select **Illuminate Screen** from the **Setup Menu** (**Figure 1.10**).

2. Press the **Clear/Enter** button to turn continuous screen lighting on or off. The instrument will then return automatically to the **Main Menu**.

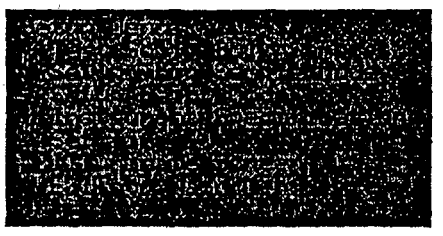


Figure 1.10
Illuminate Screen

Figure 1.11a
Cooling detectors

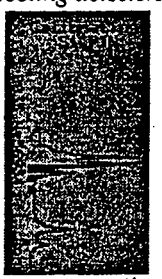


Figure 1.11b
Calibrating Pin Diode

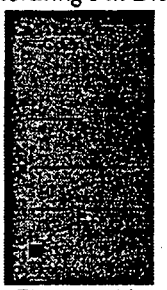


Figure 1.11c
Calibrating CZT

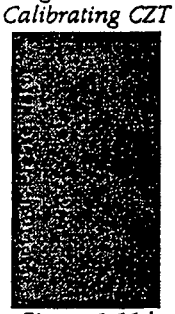


Figure 1.11d
% Complete

Calibrating Your NITON

Your NITON has been thoroughly calibrated at the factory. This calibration should be re-done every 24 months. To further assure the best Quality Assurance/Quality Control, your NITON performs a second self-calibration check every time you turn on or reset the instrument to a new mode.

In addition, NITON has provided you with several standard samples so you may check both calibrations. These tests against known standards insure that the instrument is functioning properly and can validate your results with a permanent record of regular calibrations.

Instrument Self-Calibration

When the screen arrow (->) is on Calibrate & test, press Clear/Enter to start the self-calibration process (**Figure1.11a-d**). Self-calibration takes one to two minutes. When it is completed, the instrument will beep and the Ready to Test screen will appear.

The Ready to Test Screen

The **Ready to Test** screen (**Figure 1.12**) displays the following fields:

- The current **Date** and **Time.**

Caution: Check the Date and Time. If they are not correct, reset them before taking any measurements (see page 10). Your readings will not be accurate unless the date and time are correct.

- The instrument **Serial Number**.
- The indication that the instrument is **Ready to Test**
- The **testing mode** the instrument is ready to test in.

- The **Action level** the instrument will use to make either a "Positive" or "Negative" determination of lead in paint testing. The Action-level is only used in paint testing modes.

- The **Energy Resolution**. The lower the number (in eV), the better the instrument will perform.

Caution: If you try to calibrate the instrument and it does not calibrate successfully, push the Reset Button on the bottom of the instrument and recalibrate. If your NITON does not calibrate successfully in three attempts, please call the NITON Service Department at (401) 294-1234.

- The **Source Strength** (Src Strength). The Source Strength indicates the current activity of the radioactive sources in your instrument, in millicuries. Your NITON will compensate automatically for the decay of the source.

Re-Calibrating Your NITON During Testing

To insure the accuracy and precision of your NITON, it is recommended that you re-calibrate hourly during testing. In rapidly changing environmental conditions, your NITON may require you to stop and recalibrate before resuming testing. To recalibrate:

Press the reset button on the bottom of your NITON. or
Turn the NITON off, then on, and press the Clear/Enter button.

Note: **Occasionally, the screen will display the following message: YOU MUST RECALIBRATE. This typically happens when there is a sudden, very large change in the ambient temperature. If this occurs, recalibrate and continue testing.**

User Calibration on Standard Samples

NITON provides sets of standard samples for each testing mode. These are used to check the calibration of the instrument:

- For **Bulk Sample Mode**, there is a set of three NIST soil standards: Lead high, Lead medium, and lead low.
- For **Thin Sample Mode** there is a set of three thin film standards: lead, copper, and iron. This mode should not be used for quantitative lead paint testing.
- For **Lead Paint Mode**, there is a set of government-traceable lead paint films.

Note: **Although the standards do not contain every element our multi-element analyzers test for, when an instrument correctly measures the standards you have received with your 700, your NITON will correctly measure the other elements.**

Test the standards regularly. NITON recommends testing immediately after the instrument finishes self-calibration. Test the standard samples appropriate to the type of tests you are conducting, and once every 1–2 hours thereafter.

Note: **For defensible Quality Control, keep a record of the time and precision of every calibration, using the bar code system wherever possible.**

Warning: Tampering with the 5,500 ppm lead-in-soil standard may cause exposure to lead dust. Keep all standards out of reach of children.

Caution: Never tamper with Test Standards. They should not be used unless they are completely intact.

Soil and Thin Film Standards

To test soil or thin film standards, place the sample in the test platform receptacle and proceed to test as with any prepared sample. The NITON standard soil samples provided with your instrument contain known amounts of several elements.

Caution: Do not contaminate the thin film samples with your fingerprints. Handle them by the edges with clean hands.

Lead Paint Standards

1. Place the NITON standard with the colored side face up. Choose the RED strip labelled 1.0 ± 0.1. Take a reading of that standard. Place the instrument on the standard so that the instrument window is fully on the standard. Your NITON should display a value between 0.9 and 1.2 mg/cm² and should indicate surface lead.

2. Place the same standard with the colored side down so that the instrument window is fully on the standard. Take a reading of the standard (buried beneath the equivalent of 5–6 coats of non-lead paint). Your NITON should still display a value between 0.9 and 1.2 mg/cm² and should not display Surface lead.

Note: **If your instrument is testing high on Standard samples, check only the surface the Standards are resting on. That surface may contain lead.**

When you test the Standard samples, your instrument should give readings that approximate the certified values. Your instrument should give consistent readings for each sample.

Overview of Test Modes

The **Setup Menu** allows you to choose the pre-programmed test mode best suited for the type of testing that you will be doing. For a more detailed explanation of each test mode, see the appropriate chapter in this guide.

Note: **The Setup Menu shows all NITON analyzer modes for all instruments. If you select a test mode which is not available on your NITON instrument, a reminder message will be displayed on the screen.**

Please contact NITON instrument sales at (800) 875-1578 or your local NITON sales representative to enquire about upgrading your NITON analyzer to add capabilities.

Use the Arrow buttons to select the mode you wish to test in. Press Clear/Enter to activate the mode.

Note: **All NITON analyzers correct automatically and continuously for cross-element interference in all modes throughout each test. Please see Appendix E, *Multi-Element Analysis* for more details.**

The Bulk Sample Mode

Bulk Sample Mode can be used to measure concentrations of contaminants in any fairly homogeneous, fine-grained medium such as soil, ground-up paint chips, a liquid or many other kinds of bulk materials.

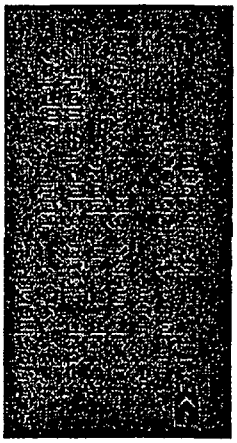


Figure 1.12
Setup Menu

To test in Bulk Sample Mode:

1. Use the Arrow buttons to select Test Soil, Bulk Samples from the Setup Menu (**Figure 1.12**). Press the **Clear/Enter** button.
2. The instrument will return to the Main Menu ready to Calibrate & Test in Bulk Sample Mode. Press the Clear/Enter button.
3. The instrument will initiate self-calibration. This will take one to two minutes. When self-calibration is complete, the instrument will beep and display the Ready to Test screen for Bulk Sample Mode (**Figure 1.13**).
4. See Chapter 3: Testing Bulk Samples for details on how to test particular kinds of bulk samples.

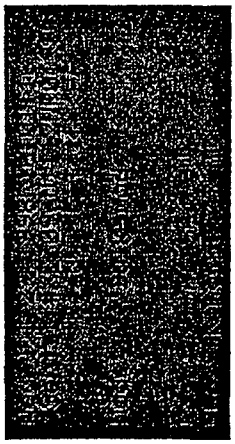


Figure 1.13
Ready to Test Screen
Bulk Sample Mode

The Thin Sample Modes

Thin Sample Modes can be used to measure concentrations of contaminants in a variety of thin layers, including deposits on dust wipes, filters and many other substrates, including, for example, thin layers of uranium on concrete.

Caution: The Standard Thin Sample Mode should not be used for quantitative lead-paint testing. Use only the three Paint Testing modes to test lead-based paint.

There are five Thin Sample Testing Modes, each designed for a different type of test media:

1. **37 mm CE Filter Mode:** for 37 mm diameter filters (fiberglass or cellulose-ester) which monitor personal exposure. This mode can also be used for 37 mm filters used to analyze dust in Dust Vacuum Methods. In this Thin Sample Mode, three measurements are taken, weighted, and summed for each filter.

2. **TSP/PM Filter Mode:** for larger filters which monitor the concentration of metals in air. In this mode, the instrument averages measurements taken on the filters.

3. **Dust Wipe Mode:** for dust wipe samples taken by wiping surfaces following HUD guidelines to determine risk assessment and clearance testing for lead in dust.

4. **Standard Thin Sample Mode:** for taking single measurements of samples or coatings. In this mode, results are displayed, in $\mu g/cm^2$.

5. **User-Definable Thin Sample Mode:** for specifying custom thin sample measurement protocols. This mode give you the flexibility to design your own tests.

To Test in the Thin Sample Modes:

1. From the **Setup Menu**, use the **Arrow buttons** to select Setup Thin Sample Mode. Press **Clear/Enter**.
2. The **Choose Operation Mode for Thin Samples** screen will appear (**Figure 1.14**)
3. Use the **Arrow buttons** to select the mode appropriate for the kind of thin samples you are going to test. Press **Clear/Enter**.
4. The **Choose Operation Mode for Thin Samples** screen will highlight the thin sample mode you have selected and the cursor will move to Exit to **Main Menu** (**Figure 1.15**). Press the **Clear/Enter** button to return to the Main Menu. Press the **Clear/Enter** button again to initiate **Calibration & Testing** in the thin sample mode you have selected.
5. The instrument will initiate self-calibration. This will take one to two minutes. When calibration is complete, the instrument will beep and display the **Ready to Test** screen for the thin sample mode you have selected (**Figure 1.16**).
6. See ***Chapter 4: Analyzing Thin Samples***, for a more complete description on how to test thin samples.

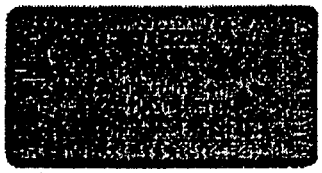


Figure 1.14
Choose Operation Mode for Thin Samples

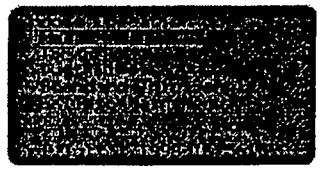


Figure 1.15
Exit to Main Menu

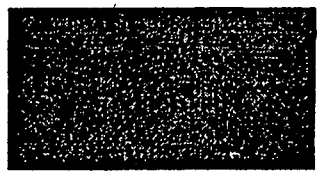


Figure 1.16
Ready to Test Screen Thin Sample Mode

The Paint Modes

All three Paint Modes can be used interchangeably to measure lead concentrations in paint in mg/cm². You many toggle among these modes. In each paint mode, NITON analyzers simultaneously measure and analyze both K-shell and L-shell lead x-rays to determine

- the numerical value of the lead in mg/cm² present in the sample; and
- whether the sample has a lead concentration that is greater-than-or-equal-to ("Positive") or less-than ("Negative") the lead Action-level (in mg/cm²) that has been entered, with 95% or better confidence.

During each test, the NITON looks at the full range of x-ray spectrum and continuously corrects for cross-element interference and, continuously corrects for substrates, comparing K- and L-shell x-rays to determine when a 95% "confident" positive or negative reading vs. the user-set action level is allowed.

Standard Paint Mode

In Standard Paint Mode, the instrument will take readings until a 95% confident reading of "Positive" or "Negative" versus the Action-level is achieved. The instrument will then display

- either "**Positive**" or "**Negative**"
- the **Result** in mg/cm², and
- display "**Surface lead**" for all "Positive" readings where the lead is not shielded by overlying layers of non-leaded paint.

In **Standard Paint Mode**, testing times will vary somewhat from sample to sample. The instrument will measure only until a 95% confident reading of "Positive" or "Negative" (according to the Action-level you have set) has been attained.

Standard Mode + Spectra

Standard Mode + Spectra is identical to **Standard Paint Mode** except that the x-ray spectrum is displayed with each reading. A spectrum confirms the presence of lead (required by many agencies).

K & L + Spectra Mode

In **K & L + Spectra Mode**, the instrument will display the complete test information continuously, from the beginning of each reading, including

- the K-shell reading with 2-sigma confidence interval
- the L-shell reading with 2-sigma confidence interval
- the combined reading (Pb) with at least 2-sigma confidence interval, and
- the x-ray spectrum from 8-22 keV and 72-90 keV.

With each reading, a "Null" result is displayed until a "Positive" or "Negative" result is determined.

In **K & L + Spectra Mode**, you may continue readings indefinitely after a "Positive" or "Negative" result is obtained, until you have attained a desired measurement time or degree of precision.

Note: **In all paint testing modes, if a test is stopped before a "Positive" or "Negative" determination has been made, you will get a "Null" test result.**

Note: **You may toggle among these three modes by pressing briefly on the Clear/Enter Button.**

To Test in the Paint Modes:

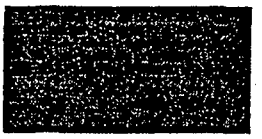


Figure 1.17
Setup Paint Mode

1. From the **Setup Menu**, use the Arrow buttons to select **Setup Paint Mode**. Press **Clear/Enter**. The **Setup Paint Mode** menu screen will appear (**Figure 1.17**)

2. Use the **Arrow buttons** to select **Set up Paint Protocol**. Press **Clear/Enter.** The Paint Protocol screen will appear (**Figure 1.18**)

Figure 1.18
Paint Protocol Screen

3. Use the **Arrow buttons** to adjust the times for the 1st beep, the 2nd beep and the 3rd beep signals (for **K & L + Spectra Mode**) and to set the Action level between 0.5 and 2.2 mg/cm^2. Use the Clear/Enter button to enter each selection.

4. When the Action-level has been entered, the Setup Paint Mode screen will re-appear (**Figure 1.17**). Now use the Arrow buttons to select a **Paint Testing Mode**. Press **Clear/Enter**.

5. The **Main Menu** will appear, with the instrument ready to **Calibrate & Test** in the paint mode you have selected. Press **Clear/Enter**.

Figure 1.19
Ready to Test: Paint Mode

6. The instrument will self-calibrate in one to two minutes. When self-calibration is complete, the instrument will beep and display the **Ready to Test** screen for the paint mode you have selected (**Figure 1.19**).

7. See Chapter 5: Testing Paint Samples, for detailed descriptions of all three paint testing modes.

SpectraView

SpectraView enables you to qualitatively analyze the fluorescent x-rays of every element in the periodic table from titanium (element 22) through plutonium (element 94) in a given sample. For lists of elements and their fluorescent x-ray energies, see Appendices G, H, and I. In SpectraView Mode, the spectrum is autoscaled logarithmically so that the highest peak on the screen reaches the top of the scale.

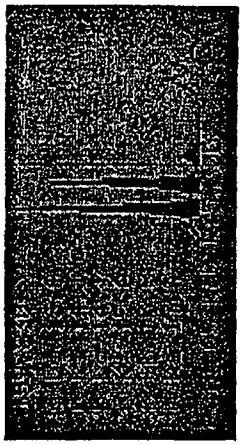


Figure 1.20
SpectraView Screen

SpectraView is standard on all 700*Series* models and on 300*Series* equipped with either the optional Lead-in-Soil Analysis package or the Dust Wipe Analysis package. It is also available on 300*Series* as a separate option.

Using SpectraView:

For NITON instruments equipped with SpectraView, you can toggle to the SpectraView screen (**Figure 1.20**) after taking a measurement in any mode by holding down the Clear/Enter button until the SpectraView screen appears. Once you are in SpectraView, you can use the Arrow buttons to scroll through the spectrum. The vertical cursor-line indicates the current position along the spectrum.

Viewing the Information in SpectraView Mode

To the left of the spectrum is a list of the elements with XRF energies close to where you are currently looking on the spectrum. (**Figure 1.21**). To determine if a given element is present, look at the bottom of the screen. Next to the number indicating the position of the SpectraView cursor on the energy-level scale (from 4 to 100 keV) is a number representing the x-ray count rate (in counts per second) at that energy-level.

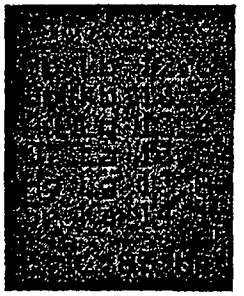


Figure 1.21
Spectrum

Note: **SpectraView cannot be used to determine quantitative element concentrations in a sample.**

SpectraView zoom

Use the SpectraView zoom feature to look at a part of the spectrum in greater detail, .

1. Use the **Arrow buttons** to move the cursor to the center of the spectral peak you wish to see more clearly.

2. Push **Clear/Enter** to increase the scale of the displayed spectrum. The spectrum may be viewed in four different scales.

3. The part of the spectrum you were looking at will appear in expanded form so you can look at it in detail (**Figure 1.22**).

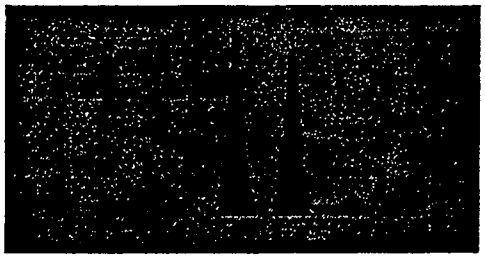


Figure 1.22
SpectraView Zoom

To Exit SpectraView

To exit SpectraView and continue testing, simply start another measurement. The measurement will be taken in the last paint testing mode you used.

Downloading data

Your NITON can store data on up to 3,000 measurements in all Paint modes, or 1,000 readings in Bulk Sample or Thin Sample modes. You can download this data to a computer to print reports or to insert data into a database. NITON recommends downloading data frequently (not less than once at the end of each day of usage) to avoid loss of data.

Note: **Downloading data does not erase readings. To make room for the next set of data, erase readings after verifying that the data was downloaded successfully (see next section).**

The RS-232 port on the back of your NITON accommodates a 4-pin LIMO connector. A LIMO to 9-pin RS-232 connector cable is provided with your NITON. Your NITON can communicate with either a "dumb" or an "intelligent" terminal, such as a VT100 connected to a mainframe computer or a PC-compatible computer.

Fast data dump;

You can download up to 3,000 measurements, their descriptions, and complete x-ray spectra (4–90 keV) in a few minutes, using NITON XTRAS Software™ provided with your instrument.
To do this:

1. Open the **XTRAS program** on your computer and open a file.
2. **Connect** your NITON to your computer with the standard RS-232 port cable that is provided.
3. From the **Main Menu**, use the **Arrow buttons**, select **Download Data** and press **Clear/Enter** (**Figure 1.23**).

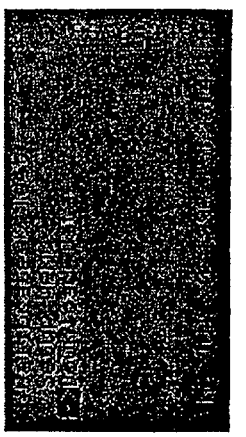


Figure 1.23
Main Menu, arrow on downloading data

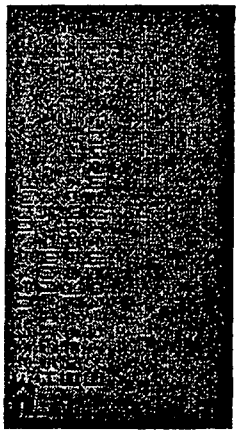


Figure 1.24
Fast Data Dump

4 From the **Download Data** menu (**Figure 1.24**) select **Fast Data Dump** and press **Clear/Enter**. Select the first to the last readings you wish to download. If you do not specify first and last readings, the default setting will download all readings currently stored in memory.

5 When the instrument finishes downloading, it will return to the **Main Menu**.

ASCII data dump

For users who wish to download data in ASCII format, the NITON can dump its data as an ASCII file to any terminal emulator program. To do this:

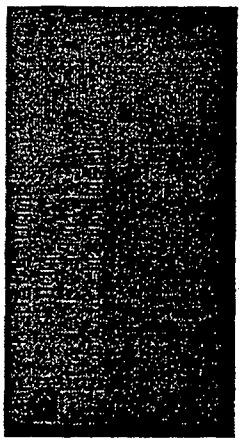


Figure 1.25
ASCII Data Dump

1 Connect the NITON to your computer with an RS-232 cable.

2 In the **Download Data** screen, press the **Arrow buttons** to scroll to **ASCII dump** (**Figure 1.25**). Press **Clear/Enter**.

3 When the instrument finishes downloading, it will return to the **Main Menu**.

Erasing readings

If you do not erase your data, the NITON will continue to record data until the memory is full. The NITON will then start to overwrite older data. Any data that is overwritten in this way will be lost.

Note: **To avoid loss of data, download your data before the memory is completely full. Clear the memory after downloading.**

The erase readings function is designed to protect you from *accidentally* erasing readings.

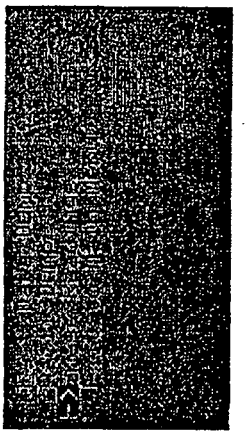


Figure 1.26
Erase Readings

To erase readings:

1. From the **Download Data** menu, use the **Arrow buttons** to scroll to **Erase Readings (Figure 1.26)**. Press **Clear/Enter**.

2. The Erase Readings screen (**Figure 1.27**) will appear with the following choices:
   ERASE all readings
   => CANCEL do not erase
   EXIT to Main Menu

3. The screen arrow defaults on **Cancel do not erase**, so that if you select it by mistake, you will not erase any readings.

4. To **Erase Readings**, use the **Up-Arrow button** to go to **ERASE all readings**. Press Clear/Enter.

   Press **YES** when the prompt asks "Are you sure?"

5. Press **Enter**. When you enter either **ERASE all readings** or **CANCEL do not erase** your instrument will return to the **Main Menu**, ready to take and store more readings.

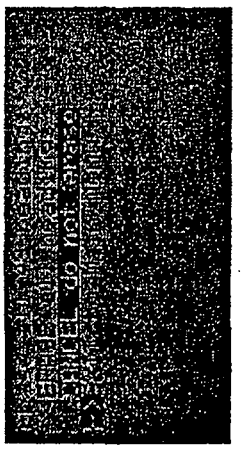


Figure 1.27
Erase Readings Screen

For further information, please refer to the XTRAS manual which is included with your NITON.

Barcode Data-Entry

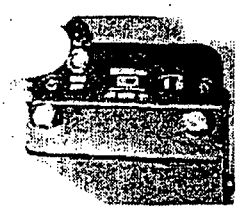


Figure 1.28
Serial Port

Model 300*Series*, 701A, 702A, 703A Analyzers:
Standard paint-testing barcodes plus no-cost option user-defined custom barcodes

Model 700, 701, 702, 703 Analyzers:
No-cost option with user-defined custom barcodes

NITON allows the instrument user to enter test location information and other data electronically, while taking readings, through the use of a portable barcode reader (light pen) that plugs into the instrument serial port (**Figure 1.28**). NITON barcode readers may be used with either standard NITON paint-testing barcode templates or user-defined barcode templates. A portable set of paint-testing barcode templates is provided with every **300*Series***, **701A, 702A** and **703A** Analyzer (**Figure 1.29**). User-defined barcode templates are discussed in the next section of this User's Guide.

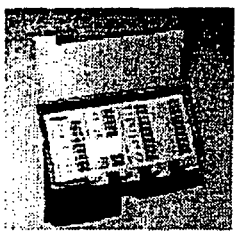


Figure 1.29
Paint Testing
Barcode Templates

All barcode-entered data appears in the Barcode Data-Entry screen (**Figure 1.30**), and is automatically downloaded with the appropriate readings. You may access the Barcode Data-Entry screen in either of two ways from any test mode:

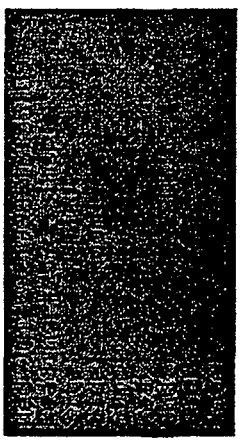


Figure 1.30
Barcode
Data Entry Screen

1. From the Ready to Test screen, hold down the Clear/Enter button for approximately six seconds, until the Barcode Data-Entry screen appears; or

2. Scan the light pen over either
   - one of the standard paint-testing barcode templates or,
   - any permissible user-defined barcode template (see next section).

Whenever the barcode reader is used, the Barcode Data-Entry screen appears automatically.

Scanning appropriate standard and/or user-defined barcodes, you may enter data in up to 11 data-entry fields for each reading. The 11 data-entry fields are:

01 Inspector number (Insp)
02 Site Number (Site)
03 Floor (Flr)
04 Side
05 Room
06 Structure (Strc)
07 Feature (Feat)
08 Condition (Cnd)
09 Substrate (Sub)
10 Color (Clr)
11 Notes (Note).

User-defined barcodes may be used in any or all of these 11 data-entry fields.

Data may be entered by barcode reader for any reading, in any test mode. To scan in a barcode, plug the barcode reader into your NITON's serial port. Hold the barcode reader like a pen or pencil, perpendicular to the barcode surface, and move the reader across the bars of the barcode you are entering. Barcodes may be scanned in using either a right-to-left or a left-to-right motion. If you accidently enter an incorrect barcode, you may delete it by scanning in the appropriate Delete barcode from the paint-testing barcode templates (**Figure 1.31**).

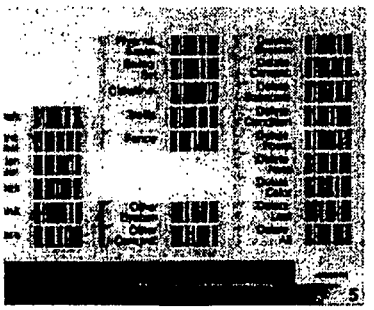


Figure 1.31
Delete Barcode from Paint Testing barcode templates

Creating Custom Barcodes with Your NITON XRF Analyzer

NITON **300*Series*** and **700*Series*** instruments can read barcode strings written in Code 39 format. This allows NITON users to make up their own barcodes to fit a variety of applications. User-defined barcodes are fully compatible with NITON XTRAS reporting software.

All user-defined barcodes created for use with NITON XRF Analyzers must be written in Code 39 (3 of 9) barcoding format.

The NITON XRF will not accept barcodes of any other symbology. You can create barcodes using any commercially available software program that utilizes Code 39 barcode fonts. You have the flexibility to design and create your own barcoding sheets as long as you adhere to the protocols outlined below.

Barcoding Protocol

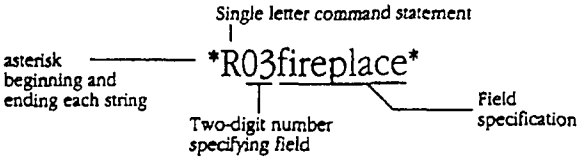


Figure 1.32: Example of a barcoding Protocol

1. An **asterisk** must begin and end each barcode string (**Figure1.32**).
2. The **initial single letter** is the comand statement for the barcode string.
   a. C is used for the CLEAR command. When this comand is read in, it will clear the specifies field of information.

b. R is used for the REPLACE command. When a barcode with this command is read in, it will automatically replace the information in a specified field with the information contained in the barcode.

c. A is used for the APPEND command. This comand is commonly used for further qualifying already existing information to information in a field. It adds, or appends, information to that which already exists in a specified field.

3. Each **field** is specified by a two-digit number. (For numbers less than 10, a 0 is placed before the integer, as shown in the example above.) Some fields are 26 characters in length, others are 13 characters, as shown in the table below.

Field Number	Current Name	Character Spaces Alloted
01	Site	26
02	Inspector	26
03	Floor	13
03	Side	13
05 Cor1	Room	26
06 Cor2	Structure	26
07 Type	Feature	26
08	Substrate	13
09	Condition	13
10	Color	13
11	Note	13

4. The information for input into a specified field may include letters, numbers, and spaces, but NOT punctuation. Once read in, the information is displayed and saved in capital letters. Capital versus lower case designations will be ignored.

The input information will be limited in length to fit the number of character spaces in a given field. If you attempt to enter a barcode with more characters than are available for a given field, the data will be truncated to fit the maximum allowable character spaces.

For example, if the phrase "underbody plow casing" was read into field 04 (maximum 13 characters), the entry would be displayed and saved as "UNDERBODY PLO" under Field 04.

Note: **If you are using a Code 39 Font in a word processing application, simply type out your barcode string in an easily readable font, highlight the string and change it into the Code 39 barcode font (Figure 1.33).**

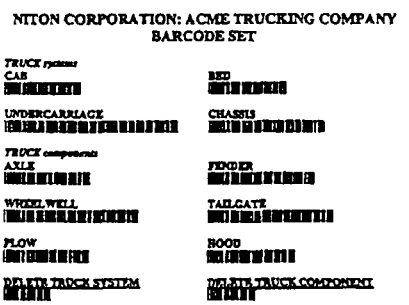


Figure 1.33
Example of custom barcode sheet in Code 39 format

Battery Packs and Battery Charger

General Information

Fully charged, each Nickel Metal Hydride battery pack gives eight or more hours of continuous use. It takes about 2-1/2 hours to fully recharge a spent battery pack if the batteries have been recently used. If the NITON has not been used for several weeks, or if the batteries are completely discharged, they must be pre-charged before they can be recharged. This will happen automatically. See Pre-Charge Mode, below.

NITON Battery packs can be recharged at least 500 times. They are warranted to be free of defect when shipped. They are not further covered by manufacturers' warranty. When they need to be replaced, new battery packs may be purchased from NITON.

Note: **Before beginning a test, be certain the battery pack has sufficient charge. It is always a good idea to carry a spare battery pack.**

Caution: NITON's Nickel Metal Hydride battery packs discharge at a rate of about 2% per day when not in use.

Pre-charge Mode

If your NITON battery packs run down completely, they must be pre-charged before recharging. If the Green charge light is blinking slowly and the Discharge and Temperature lights are off, you are in Pre-Charge Mode. The process can take up to 5 hours.

Battery Pack Routine Maintenance

Some guidelines:

- Don't leave battery packs on the charger all the time. Overnight recharging is recommended.
- To preserve the life of your battery packs, use them until they are fully discharged before recharging them.
- Don't recharge a fully charged battery pack. If you want to charge a partially charged battery, run the Discharge cycle before recharging.
- Store the charger and battery packs in a cool place (10°C - 26°C), away from direct sunlight.
- When a battery pack is not used for a long period of time, it will lose its charge completely. Fully recharge it before use.

Note: **A lithium backup battery inside your NITON will prevent any loss of data should you need to change the battery pack before downloading readings.**

Changing Battery Packs

Removing a battery pack

1. Avoid changing the battery pack outdoors. Moisture and dirt can damage a battery.
2. Rest the NITON on a clean surface.

3 Loosen the (2) clamp screws. They do not come off (Figure1.34).

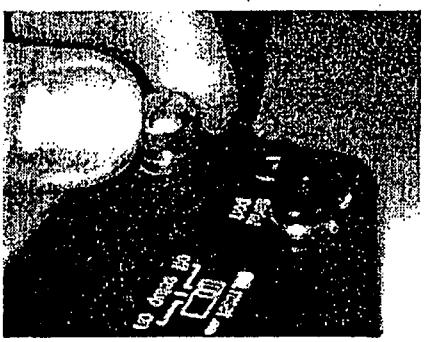


Figure 1.34
Loosen clamp screws to remove the battery pack. They do not come off.

4 Pull the battery pack away from the instrument by grasping the knurled screws and gently rocking the battery pack from side to side while removing it.

Installing a battery pack

1 Rest the NITON on a clean surface, as before.

2 Slip the notch at the bottom of the battery pack into the wide slot.

3 Gently push the battery pack in, taking care that the battery pack connector is seated properly to the instrument's connector.

4 Tighten the (2) knurled screw clamps that fit into holes on the NITON. If the screw clamps do not tighten, the connectors are not lined up properly. These screw clamps must be tight for a secure connection.

Recharging battery packs

Recharging with the AC adapter

1 Lay the battery pack on top of Battery Charger. Fit connectors together snugly (**Figure 1.35**).

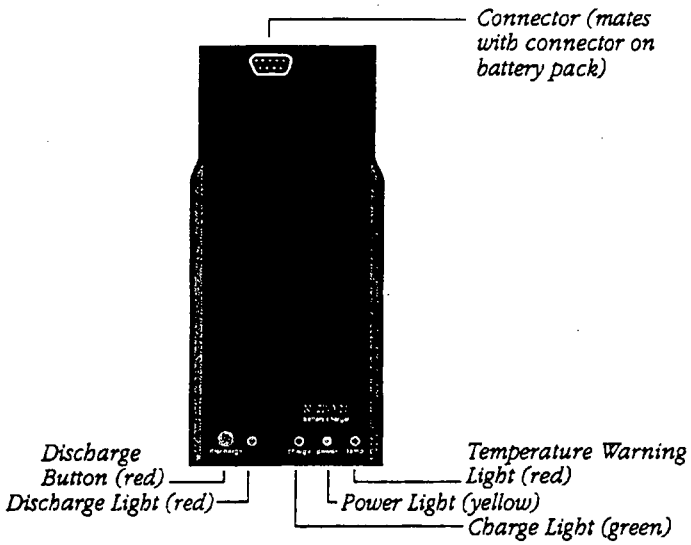


Figure 1.35
Front view of the battery charger

2 Plug one end of the AC adapter into the power port on the bottom of the charger. Push the plug in, making sure it seats fully.

3 Power up the charger: Plug the other end of the AC adapter into a 110V outlet. The yellow Power light will come on and stay on throughout. The green Charge light will also come on. It will blink slowly at first, indicating that the battery is on Pre-charge, and then stay on with a steady light, indicating that the battery is on Full Charge.

4 In Full Charge Mode, the green Charge light will stay on with a steady light while the battery is being charged. It is normal for the charger to make some noise in Full Charge mode.

5 In Trickle Charge Mode: When the battery is fully charged, the charger will automatically switch to Trickle Charge mode and the green Charge light blinks rapidly.

Caution: Do not leave battery packs on the Battery Charger longer than necessary.

Discharge cycle

Put battery packs on the Discharge Cycle only if they are not holding a charge; or, if they are partially charged, run the Discharge Cycle before recharging. It takes about eight hours to fully discharge a battery pack. To discharge a battery pack, place it on the charger and:

1 Press the red Discharge button. The red Discharge light will come on, and the green Charge light will blink slowly, showing charger is in Discharge mode.

2 After a full Discharge cycle, the charger will automatically recharge the battery.

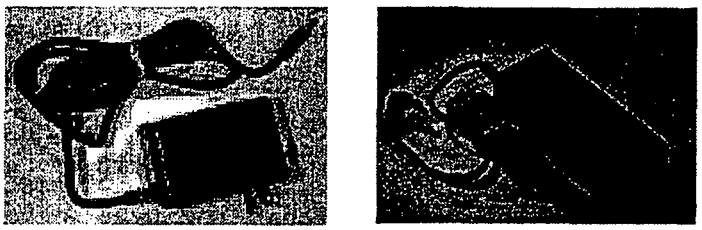
3 The red Discharge light goes out and the green Charge light will blink rapidly, showing it is in the Trickle Mode.

Caution: If the red Temp light comes on repeatedly when a battery pack is on the battery charger in the Full Charge cycle, call NITON Customer Service at (401) 294-1234.

Caution: Do not store the battery packs or battery charger in direct sunlight.

Using your vehicle's 12V DC outlet

A 12V DC Adapter is provided with your NITON (**Figure 1.36**). Instructions are the same as for using the 110V AC Adapter. When you have seated all connections well, the yellow **Power** light will come on.



Domestic Power Adapter *International Power Adapter*

Figure 1.36
DC Power Adapters: Domestic and International

Caution: Do not use the Discharge Cycle while on the DC outlet.

- Secure the charger so the power cord does not get pulled out while the vehicle is in motion.
- The plug of the DC Adapter has a 5A internal fuse. To check the fuse, unscrew the cap that retains the contact from the end of the plug. Replace this fuse only with a 5A fuse of the same size. If the fuse in the 12V Adapter burns out frequently, call NITON's Service Department at (401) 294-1234.

Note: **Please do not throw away spent battery packs. Return spent battery packs to NITON so they can be properly disposed of.**

Maintenance, Cleaning and Repairs

NITON Corporation welcomes any questions or comments you may have about your NITON analyzer. Please do not hesitate to call us at either our Main Office number: (781) 275-9275 or at our Rhode Island Service Facility number: (401) 294-1234.

Caution: All Service except exterior cleaning must be performed by NITON Corporation. Do not attempt to make repairs yourself. Opening the case of your NITON will void the instrument Warranty.

Keep your NITON clean, particularly the capton plastic window on the bottom of the instrument. If the window is dirty, the performance of your NITON will be affected. Clean the window gently with cotton swabs. Clean the instrument's metal case with a soft cloth. Never use water, detergents, or solvents. These may damage the instrument.

Note: **Never ship your NITON analyzer back to the factory for any reason without calling and obtaining a Return Authorization (RA) Number from NITON Corporation.**

Storage, Transport, and Shipping

Storing and Transporting Your NITON

All NITON instruments come in waterproof, drop-proof carrying cases with padlocks. NITON instruments can be transported by car or plane or shipped as an ordinary package. There are no restrictions for tunnels or bridges. No notification is required for transportation except the following: There may be disclosure and/or licensing requirements if you take your NITON instrument across state or national boundaries. Please check with the appropriate agencies for details. To keep up with the latest agency changes visit the NITON web site at http://www.niton.com .

Your NITON is an "excepted" instrument which requires no special labelling on the outside of case or packaging. A compliance statement must be kept with the instrument case. Always transport the unit in its carrying case, and keep the NITON in its case whenever it is not being used. Store the instrument, in its case, in a secure area.

Shipping your NITON

All NITON instruments must be packed in their original padded carrying cases for shipment. Pack the NITON in its carrying case and ship in either the original carton and packing material or their equivalent.

Caution: Do not ship your instrument back to NITON for any reason without first notifying NITON Corporation and receiving a Return Authorization Number.

Caution: If you return your NITON without the carrying case you will void the instrument warranty. You will also be billed for a replacement case plus any repairs resulting from improper shipping.

Always enclose a copy of a current leak test certificate when you ship your instrument back to NITON.

Caution: NITON's license prohibits us from repairing or upgrading any of our XRF instruments without a current leak test certificate. If you return an instrument without a current leak test certificate, NITON will perform a leak test and bill you.

Note: **Keep a copy of the following statement in the NITON case whenever the instrument is shipped:**

DEPARTMENT OF TRANSPORTATION

THE NITON SPECTRUM ANALYZER CONFORMS TO THE CONDITIONS AND LIMITATIONS SPECIFIED IN 49 CFR 173.422 FOR EXCEPTED PACKAGE, INSTRUMENTS AND ARTICLES, N.O.S. UN—2910. THIS PACKAGE CONTAINS NO MORE THAN 50 mCi CADMIUM-109 IN A PLATED, SOLID, SEALED SOURCE INSTALLED IN AN X-RAY FLUORESCENCE ANALYZER.

Radiation Safety

NITON has designed its XRF analyzers so that there is virtually no measurable radiation external to any part of the instrument when the shutter is closed. When our instruments are used according to instructions, there is minimal radiation exposure even with the shutter open. NITON XRFs contain sealed cadmium-109 radioactive sources. The source is designed to remain secure even under extreme conditions, so that even if the instrument is broken, crushed or burned, there will be no leakage of radioactive material.

During manufacturing, each sealed source is placed in a solid metal source holder. A plug is screwed into the access hole and secured with a set screw and Locktite. The source is completely secure in its housing beacause the aperture at the other end of the housing is smaller than the source. The small aperture is sealed with a beryllium metal window that is transparent to the cadmium x-rays and gamma-rays. The source assembly is secured in the NITON's aluminum case. The case has tamper proof screws.

The following table lists typical radiation doses encountered in everyday living and lists the annual occupational radiation dosage limits for adults set forth in NITON's Materials license from the Rhode Island Radiation Control Agency, Section A.2.3.

Typical Radiation Doses in mR (NCRP, 1987)

Average total dose in US. (annual)	360 mR
Average worker exposure (annual)	210 mR
Average exposure for underground miner (annual)	400 mR
Exposure for airline crew (1,000 hours at 35,000 ft)	500 mR
Additional from living in Denver at 5300' (annual)	25 mR
Additional from 4 pCi/l radon in home (annual)	1,000 mR
Typical chest x-ray	6 mR
Typical head or neck x-ray	20 mR
Typical pelvis/hip x-ray	65 mR
Typical lumbar spine x-ray	130 mR
Typical upper G.I. x-ray	245 mR
Typical barium enema x-ray	405 mR
Typical CAT scan	110 mR
Minimum detectable dose on a standard film badge	5 mR

Annual occupational dosage limits:

Maximum allowable for the general public (annual)	100 mR
Annual Occupational Dose Limits for Adults:	
The lesser of (1) total effective radiation dose	5 ,000 mR
or the (2) sum of the deep dose equivalent plus the committed dose equivalent to any individual organ or tissue *other* than the lens of the eye	50,000 mR
For a pregnant worker (during gestation period)	500 mR
For a minor	500 mR
Eye dose equivalent	15,000 mR
Shallow dose equivalent to the skin or any extremity	50,000 mR

How to use your NITON safely

Each NITON is designed to be safe as possible. However, we strongly recommend that you follow these precautions to insure your safety and the safety of those around you:

- Always be aware of the location of your instrument's radioactive source and the direction of its beam of x-rays. The location of the source and the direction of its beam are both clearly marked on the front (**Figure 2.01**) and top side (**Figure 2.02**) of your NITON.
- Open the shutter *only* to do a test.
- During testing, a strong beam of radiation (gamma-rays and x-rays) is continuously emitted through the beryllium window at the bottom of the NITON. There will be some radiation at the front and top-front of the instrument. There is negligible radiation where your hand should be holding the instrument.

Warning: Always treat radiation with respect. Do not put your hand on the top end of the NITON while measuring. Never point the instrument at yourself or anyone else when the shutter is open.

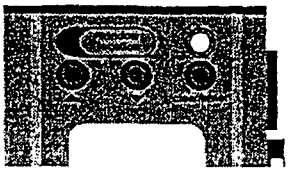


Figure 2.01
Top view of NITON with source location marked

Figure 2.02
Top view of NITON with direction of beam marked

Shutter safety

Your NITON is designed so you cannot accidently open the shutter or leave it open accidentally when you lift the instrument from a surface. To open the NITON's shutter and to keep it open, the instrument must be held against a surface. The shutter will close as soon as you cease to hold your NITON against a surface.

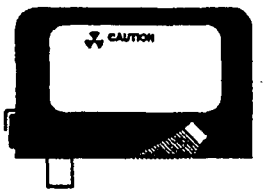


Figure 2.03
End plate with shutter in closed position

- The shutter should be open only during a test.
- Under no circumstances should the shutter be open when the instrument is not in use.
- Your NITON clearly indicates any time the shutter is open (**Figure 2.03**). The plunger will stick up through the instrument case whenever the shutter is open (**Figure 2.04**).

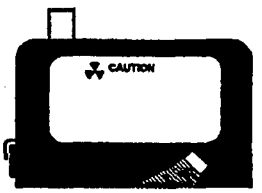


Figure 2.04
End plate with shutter in open position

Warning: In the unlikely event that the plunger gets stuck in the open position, simply push it closed. Then call the NITON Service Department at (401) 294-1234.

Monitoring your radiation exposure

There is virtually no measurable radiation from a NITON when its shutter is closed. The maximum dosage to which you are exposed when properly operating your NITON is 0.1 mR/hr on the fingers of the hand holding the instrument with the shutter open.

As an additional precaution to insure that your radiation exposure is always minimal, NITON strongly recommends that you wear a dosimeter at all times when using the instrument.

Note: **Your state may have regulations concerning radiation monitoring.**

A dosimeter badge is usually worn close to the parts of your body that are most sensitive to radiation, including your reproductive organs and your eyes. These badges are available from many companies. One company selling dosimeters is:

Landauer, Inc.
2 Science Road
Glenwood, IL 60425-9979.

Each month, your radiation badge company will send you a new badge.

Warning: Wearing a dosimeter badge does not protect you against current exposure. A dosimeter badge measures your exposure after the fact. If, at any time, you find measurable exposure, call NITON immediately at (401) 294-1234.

Warning: Pregnant female workers may want to take special precautions to reduce their exposure to radiation. Qualified scientists have recommended that the radiation dose to pregant women should not exceed 500 mR/gestation period.

The Principles of Radiation Safety

Your exposure to radiation is related to three factors: time, distance, and shielding. Human exposure to radiation is typically measured in rems, or in one-thousandths of a rem, called millirems (mR).

As noted previously in this chapter, the allowable limit in the US. for occupational exposure is 5,000 mR/year for a whole-body and 50,000 mR for shallow penetration of extremities. Exposure from a properly-used NITON will be less than 50 mR per year, even if the instrument is used 2,000 hours per year.

For a given source of radiation three factors will determine the radiation dosage you receive from the source:

Duration of Exposure

The longer you are exposed to a source of radiation the more radiation strikes your body and the greater the dose you receive. Dosage increases in direct proportion to the length of exposure.

Distance from the source

The closer you are to a source of radiation, the more radiation strikes you. The dosage increases in inverse-squared relation to the distance from the source. For example, the radiation dose one inch from a source is *nine* times greater than the dose three inches from the source, and *144* times greater than the dose one foot from the source. Keep your hand away from the source-end of your NITON when the shutter is open to minimize your exposure.

Shielding

Every NITON XRF emits virtually no radiation with the shutter closed because the cadmium-109 source is thoroughly shielded in every direction. This shielding absorbs nearly all of the radiation produced by the source—except when the shutter is open during testing. With the shutter open, the instrument emits a directed radiation beam of about one mR/hr intensity; the direction is clearly indicated by the diagram on the front of the NITON. Always hold your NITON so as to avoid the radiation beam.

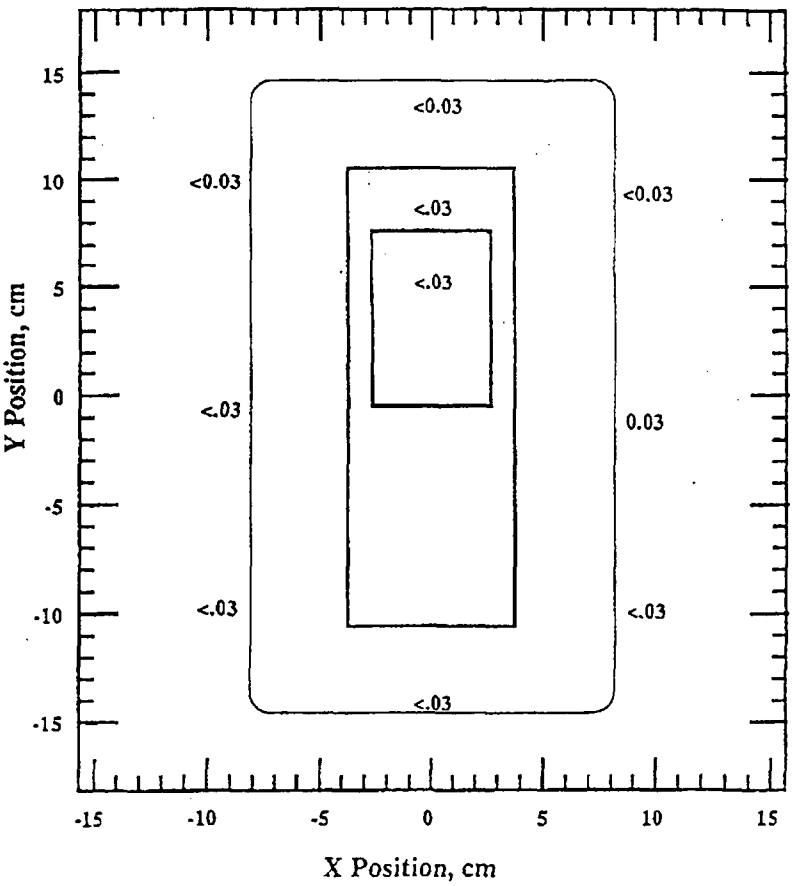
Safe Operation of the Multi-Source Analyzer

The multi-source instruments can have any combination of Cd-109, Am-241, and/or Fe-55. These sources are changed by the operation of a thumb-wheel. This thumb-wheel is located on the front (shutter) end of the instrument. There is a position for each source installed, in addition to a position with no source in place. The two source holder has three positions, and the three source holder has four positions. Position is confirmed by the thumb-wheel "clicking" into place. The Cd-109 is indicated by a blue indicator dot on the thumb-wheel. The Am-241 is indicated by a yellow indicator dot on the thumb-wheel. The Fe-55 is indicated by a red indicator dot on the thumb-wheel. The source that is in position will be displayed on the screen of the instrument.

The operation of the thumb-wheel in no way affects the operation of the instrument shutter. The thumb-wheel must only be operated either with the shutter closed or while the instrument is positioned on a sample. Follow all instructions concerning the operation of the shutter as the single source instrument.

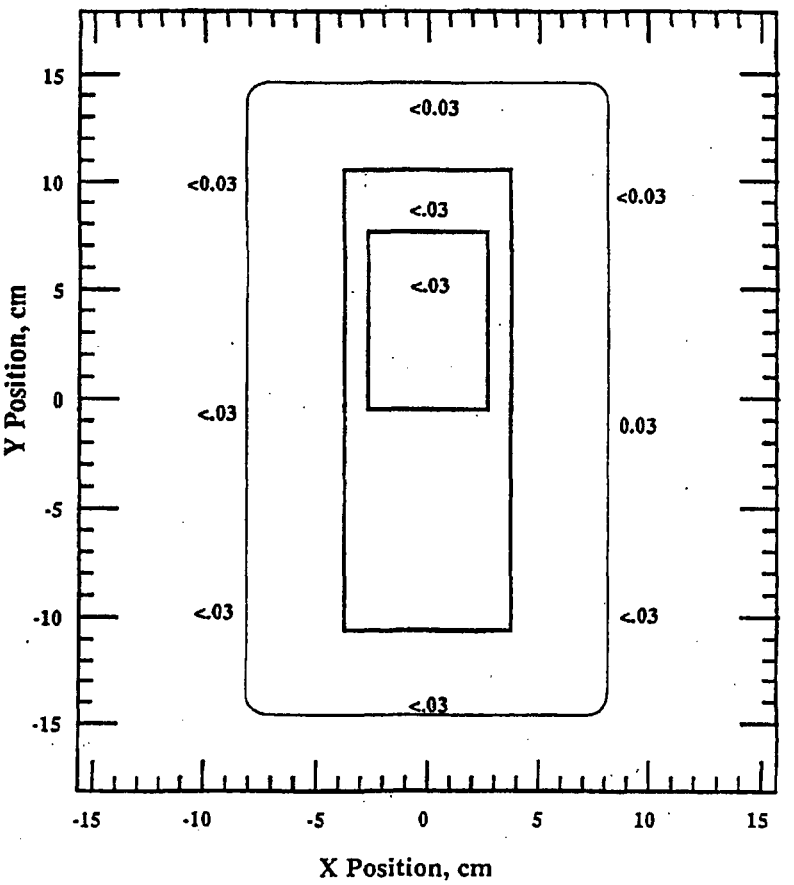
Instrument radiation profiles

Radiation Profile of NITON Analyzer on Sheetrock Substrate in mR/hr for 50 mCi ^{109}Cd Source with Shutter Closed (Nov 7 93)



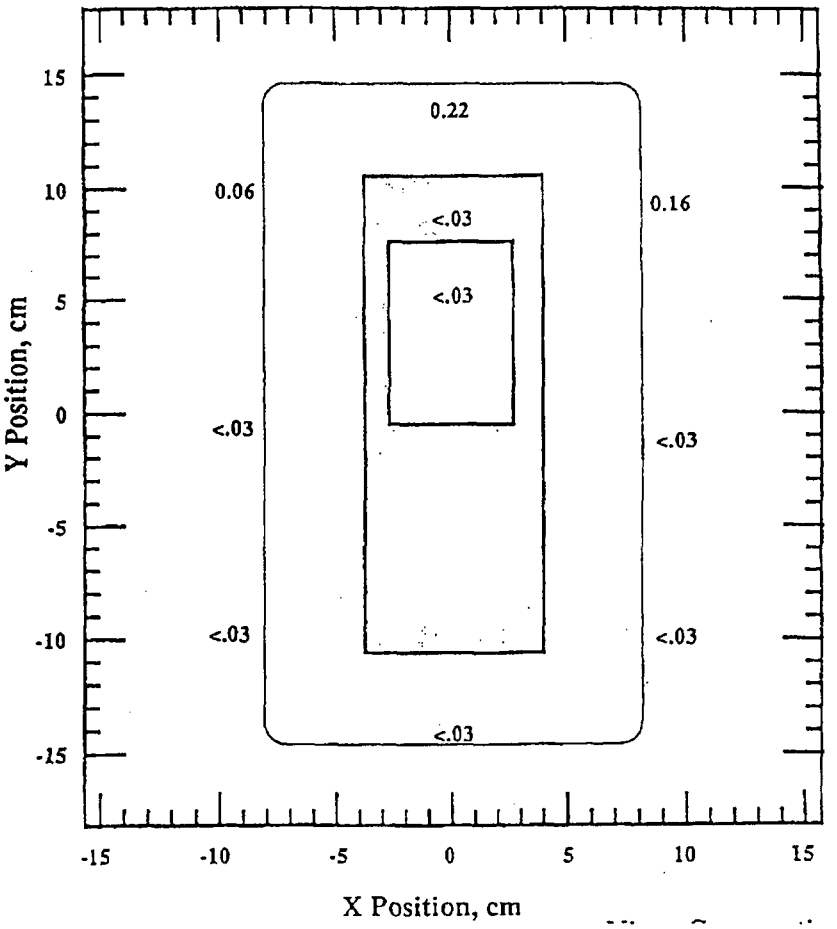
Instrument radiation profiles

Radiation Profile of NITON Analyzer on Sheetrock substrate in mR/hr for 10 mCi ^{109}Cd Source with Shutter Open (Nov 7 93)



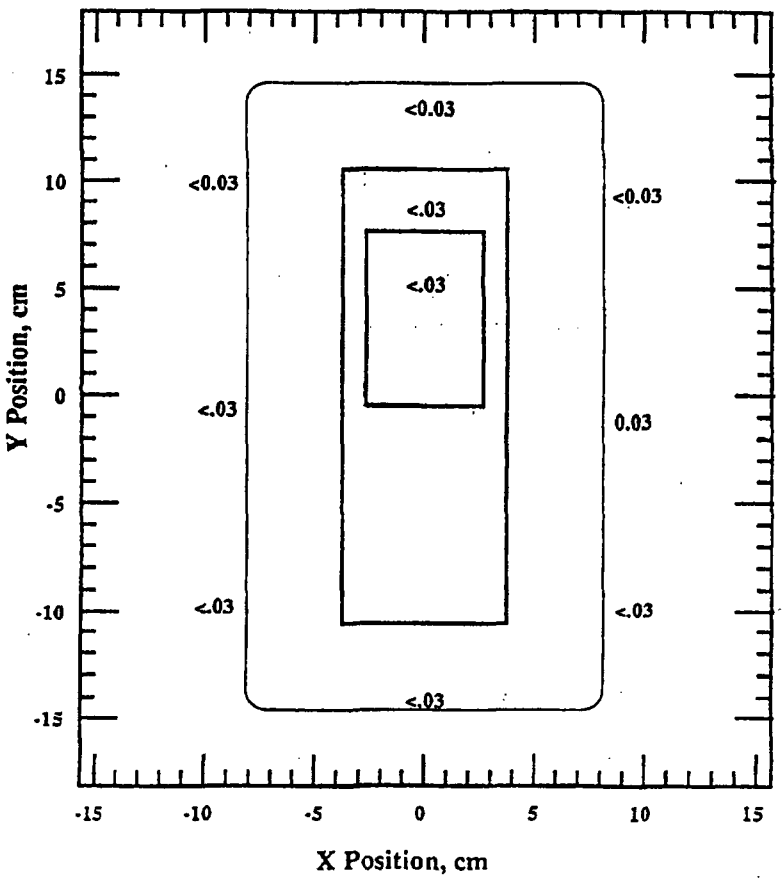
Instrument radiation profiles

Radiation Profile of NITON Analyzer on Wood Substrate in mR/hr for 50 mCi ^{109}Cd Source with Shutter Closed (Sept 14 94)



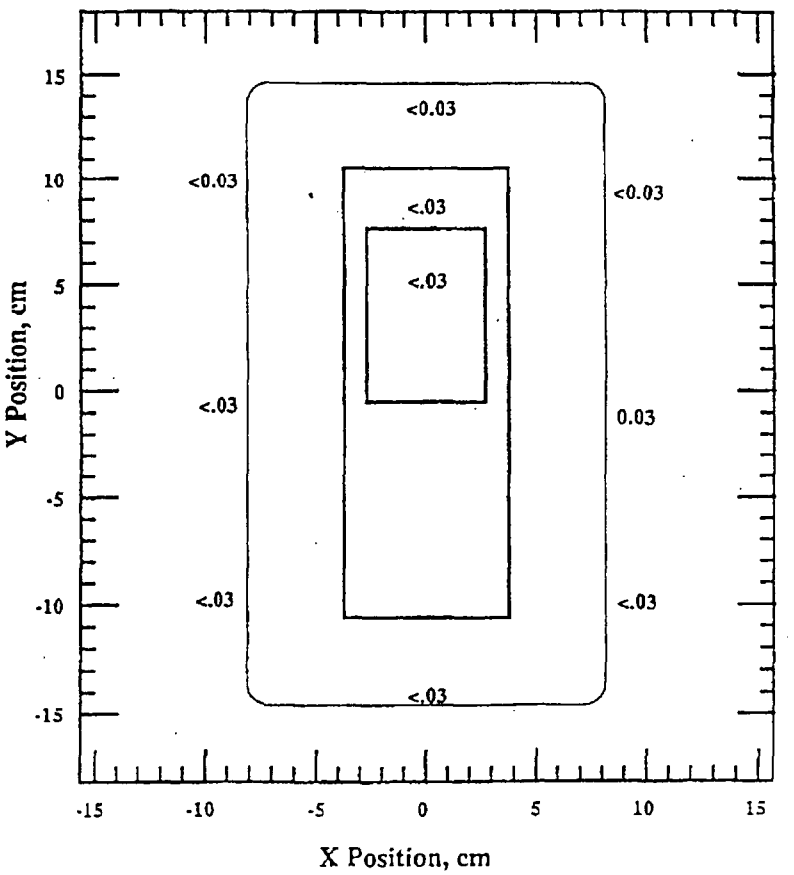
Instrument radiation profiles

Radiation Profile of NITON Analyzer with 10 mCi sources of ^{109}Cd, ^{241}AM, and ^{55}Fe, on 3/4" wood, with both shutters closed. Radiation strengths in mR/hour.



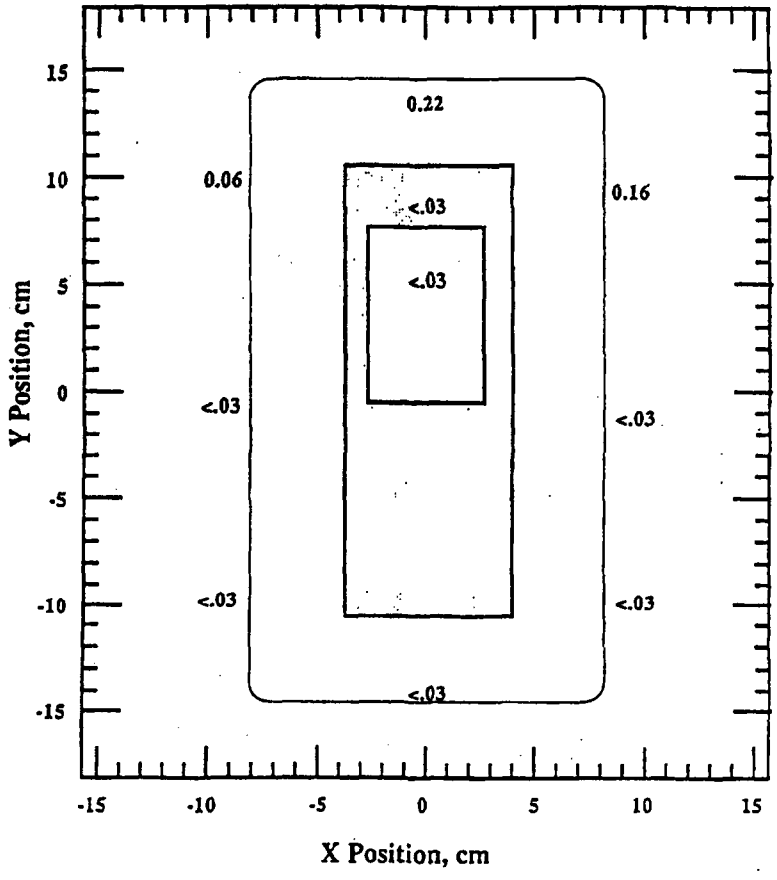
Instrument radiation profiles

Radiation Profile of 3-source NITON Analyzer with 10 mCi sources of ^{109}Cd, ^{241}AM, and ^{55}Fe, on 3/4" wood, with either the inner or the outer shutters closed. Radiation strengths in mR/hour.



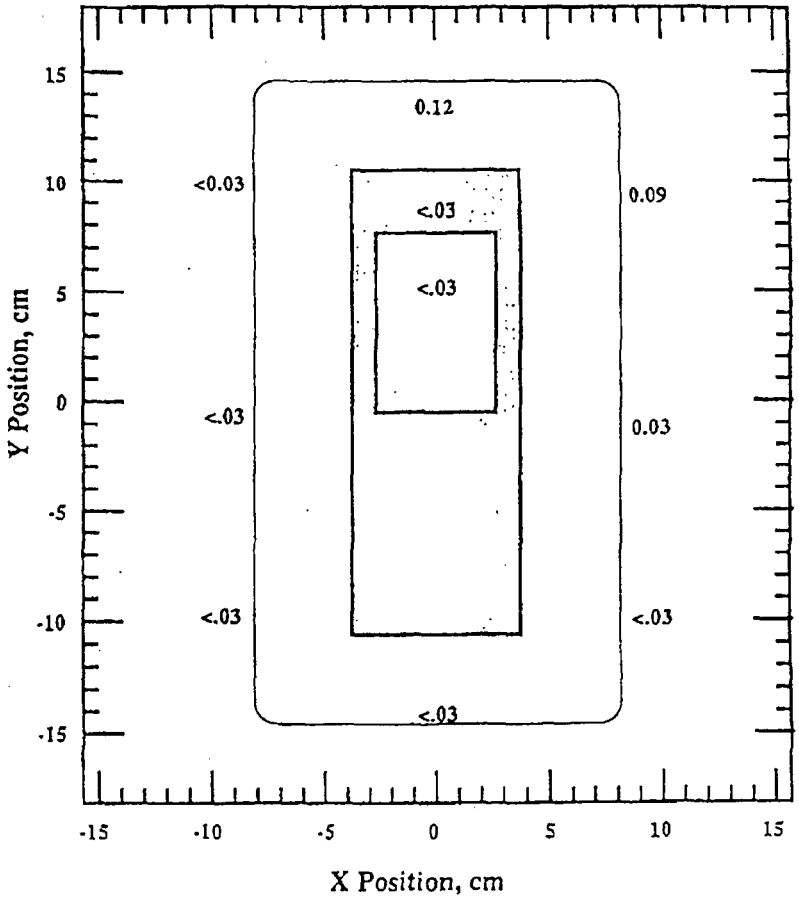
Instrument radiation profiles

Radiation Profile of NITON Analyzer with 10 mCi sources of ^{109}Cd, ^{241}AM, and ^{55}Fe, on 3/4" wood, with both shutters open. Radiation strengths in mR/hour.



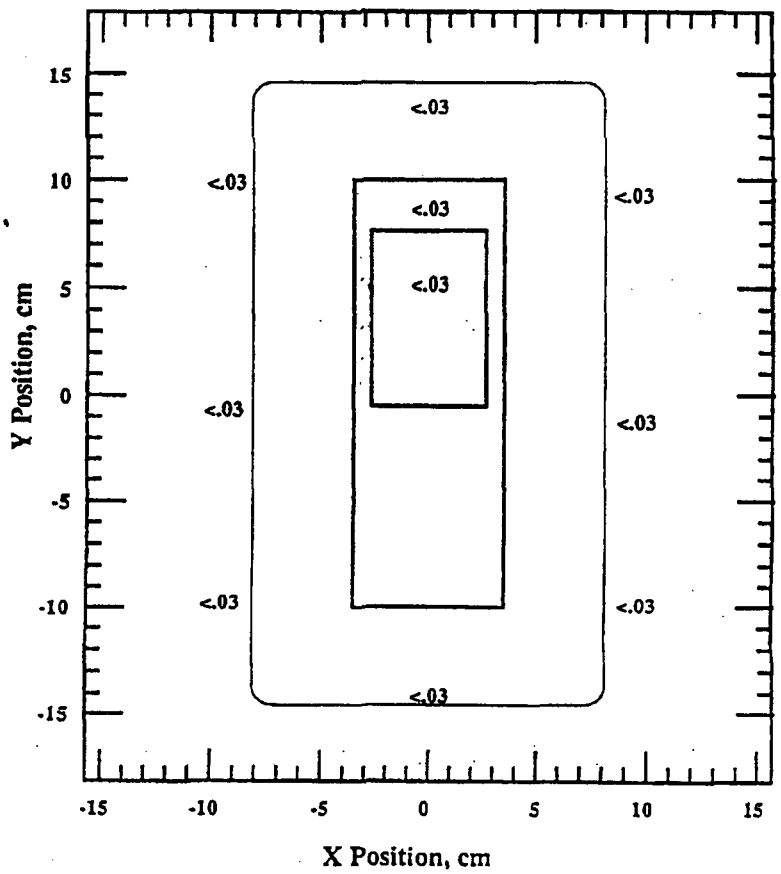
Instrument radiation profiles

Radiation Profile of NITON Analyzer with 10 mCi sources of ^{109}Cd, ^{241}AM, and ^{55}Fe, on 3/4" wood, with both shutters open, ^{109}Cd operating. Radiation strengths in mR/hour.



Instrument radiation profiles

Radiation Profile of 3-Source NITON Analyzer with 10 mCi sources of ^{109}Cd, ^{241}AM, and ^{55}Fe, on 3/4" wood, with both shutters open, ^{55}Fe operating. Radiation strengths in mR/hour.



Wipe testing

The shielding on your NITON is designed to hold up even under extreme conditions, including the instrument's being crushed or burned. The continued effectiveness of the instrument's radiation shielding should be tested every six months with a thorough leak test of the instrument (**Figure 2.05**).

NITON's license requires that leak tests be done every 6 months. Leak test kits, with full instructions, are available from several vendors. These vendors will remind you when it's time to do another semi-annual leak test on your NITON. Please follow the accompanying instructions and promptly mail the test sample to the laboratory. The following are just a few of the labs that offer leak tests:

Applied Health Physics
2986 Industrial Blvd.
Bethel Park, PA 15102
Tel: (412) 835-9555

Stan A. Huber Consultants
200 N. Cedar Road
New Lennox, IL 60451
Tel: (800) 383-0468

Valley Safety Services
330 Old Enfield Road
Belchertown, MA 01007
Tel: (413) 323-9571

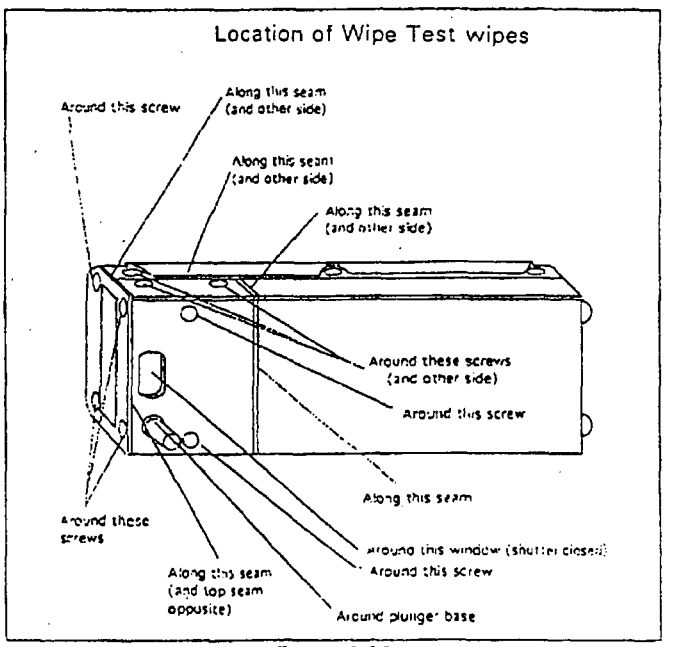


Figure 2.05
Leak Test: Location of Test Wipes.
NOTE: MUST BE DONE WITH SHUTTER CLOSED

If your NITON is damaged, destroyed, lost or stolen:

Immediately

1 **Notify the Office of Radiological Safety in your state Dept. of Health.**

- Telephone: _____

2 **Notify NITON Corp's Radiation Safety Officer, Ken Martin, C.I.H.**

- During regular business hours: (800) 875-1578
- Evenings and weekends: (617) 923-6312

3 **If your NITON is lost or stolen, or damaged in a car accident:**

- **Also *immediately* notify your State Police.**

  Telephone: _____

4 **If your NITON is damaged in a fire or an explosion:**

- **Also immediately notify your local fire department.**

  Telephone: _____

Please fill in the phone numbers on this page today.
Keep copies where you can find them in case of an emergency.

Analyzing bulk samples

Overview

The NITON *300Series* may be used to test lead in soil and ground-up paint chips if equipped with optional Lead In Soil Analysis software and hardware. 702, 702-A, 703 and 703-A Model Spectrum Analyzers are multi-element analyzers for bulk media, thick samples of materials such as soil, sludge, and various liquids. Applications include:

- in-situ soil testing
- in-situ materials testing (e.g., contaminated concrete)
- bagged soil sample testing
- testing sludge, sediments, liquids, and dust in cups,
- testing prepared soil samples.

Before You Test

Turn your NITON on at least 15 minutes prior to testing in Bulk Sample Mode. This will give you more precise measurements.

NITON provides three NIST soil standards: Lead high, Lead medium, and lead low to check the calibration of the instrument when testing in bulk sample mode.

Note: **Although the standards do not contain every element our multi-element analyzers test for, when an instrument correctly measures the standards you have have received with your 700, your NITON will correctly measure the other elements.**

Test the standards regularly. NITON recommends testing immediately after the instrument finishes self-calibration. Test the standard samples appropriate to the type of tests you are conducting, and once every 1–2 hours thereafter.

Note: **For defensible Quality Control, keep a record of the time and precision of every calibration, using the bar code system wherever possible.**

Warning: Tampering with the 5,500 ppm lead-in-soil standard may cause exposure to lead dust. Keep all standards out of reach of children.

Caution: Never tamper with Test Standards. They should not be used unless they are completely intact.

During each test, the NITON looks at the full range of the x-ray spectrum and continuously corrects for cross-element interferences.

Testing in Bulk Sample Mode

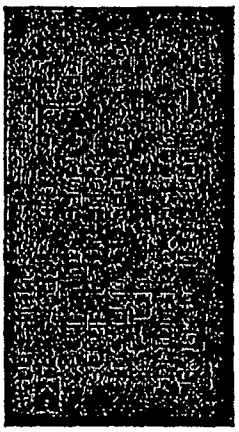


Figure 3.01
Setup Menu
Test Soil, Bulk Samples

Choose the **Bulk Sample Mode** from the Setup screen (Figure 3.01).

Testing methods for bulk media are generally of two types:

- Field screening and
- testing prepared samples.

Understanding the difference between these two types of analysis is crucial to getting good data. Field screening should be used to

- profile an area,
- locate sources of contamination,
- determine the boundaries of contamination, or
- gather data that will subsequently be used to design a sampling plan.

Field screening is usually only approximate; it will correlate very well with lab analysis for a highly-homogeneous sample, but may correlate extremely poorly for a non-homogeneous sample.

Note: Never use in-situ testing to compare field XRF results to laboratory results. For XRF evaluation purposes, use only well-prepared samples (see page 3-10).

When comparing field screening to laboratory analysis, try to compare the same samples. For best results, collect a large sample in a zipper locking storage bag. Shake the bag to mix the sample. Test the bagged sample several times using the NITON and average the readings. Then compare this average reading with lab results.

If you must test in-situ for performance evaluation, take several XRF readings bracketing a spot. Then take a sample for laboratory testing from that spot. For further discussion of field screening, see EPA Method 6200, "Field Screening Using a Field-Portable XRF." Contact NITON for a copy. The EPA accepts field screening using the NITON if the screening is performed using Method 6200. Most states accept EPA Method 6200.

The measurement screen

On NITON 300*Series* with optional Lead in Soil Analysis, only lead is displayed in bulk sample testing. On 700*Series* models, only the two highest-concentration elements are displayed (in ppm, with the two-sigma confidence intervals) on the first Measurement screen (**Figure 3.02a**), with the x-ray spectrum. The black bars on the spectrum display highlight the presence or absence of lead or iron in the sample. The test time is also displayed in nominal (source) seconds.

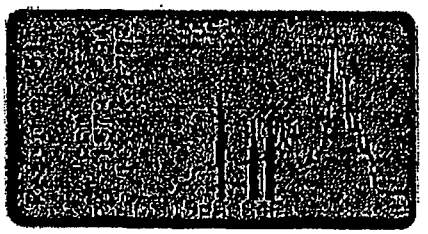


Figure 3.02a
Measurement Screen
Bulk Sample Mode

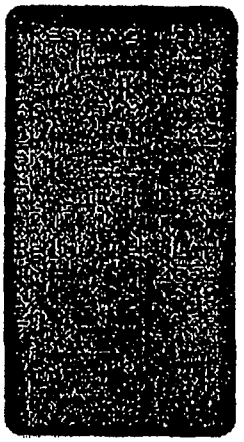


Figure 3.02b
The Summary Screen
Bulk Sample Mode

The summary screen

When you end a reading, the **Measurement Screen** will be replaced by the Summary Screen (**Figure 3.02b**). On 700 models, results are displayed for 14 elements. These elements are divided into two groups:

- elements that were detected in the sample, and
- elements that were not detected.

Press the **Arrow buttons** to scroll through the elements.

Detection Limit: For an element to be detected by the NITON in a given sample, the measured concentration of the sample must be at least three times the standard deviation of the measurement. This detection limit will depend on the composition of the sample.

Precision: The measurement precision for each element displayed appears to the right of the measured concentration, under the heading "+-". The **precision** of each measurment is two times the standard deviation (sigma).

An element is classified **detected** if the measured concentration (in ppm) is at least 1.5 times the precision. Detected elements are displayed as in the Measurement Screen. Non-detected elements are shown as < "xx", where "xx" is the detection limit for that sample. The detection limit for each element is calculated from each sample.

In-situ surveys

Before you take your first measurement, you must decide whether to test the bulk material

- in-situ (in-place)
- as bagged samples (or, for liquids and sludge, in cups) with a minimum of preparation, or
- in an XRF cup after careful preparation.

Note: More sample preparation (drying, milling and sieving) will yield greater accuracy. The drier, finer, and more homogeneous the particles, the better the measurements.

Screening Techniques

Use direct measurement when you need to determine whether an element is present (rather than in accurately measuring how much is present). Use preliminary direct measurements to survey a site quickly even if you intend to take samples. Analyzing bagged samples can also be used for screening.

The NITON test guard

The NITON Test Guard (Figure 3.03a,b) is a formed metal plate designed to be placed directly between the ground or other bulk media and the NITON. The Test Guard shields the unit from contamination and damage. Use the Test Guard for surveys of bulk media in-situ or for testing bulk samples in bags.

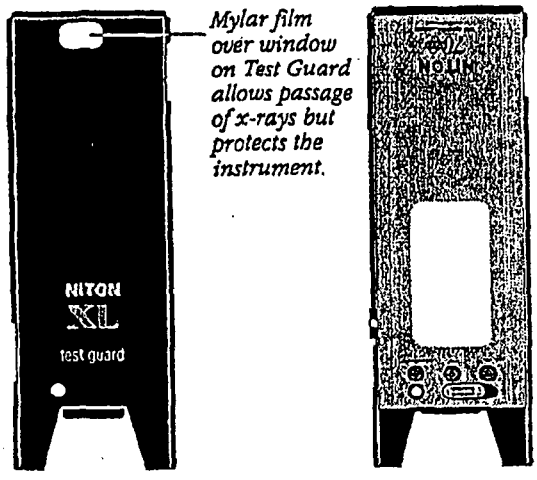


Figure 3.03a
NITON Test Guard

Figure 3.03b
NITON Test Guard with instrument in place

Testing in-situ

Warning: When taking samples from a site where toxic chemicals may be present, always use gloves and respiration equipment for your own protection.

1 **Select a measurement site**
Valid results will depend on a sufficient and appropriate selection of sites to sample. Lead-in-soil from paint, for instance, will be concentrated within a few feet of the painted structure.

2 **Clear any surface debris or vegetation.**
Use a flat area so that the NITON will contact the test medium. The finer and more homogeneous the material, the more accurate the measurement. (You can increase your accuracy when testing soil by loosening the soil and letting it dry in the sun before testing.)

3 **Place the test guard on ground.**
Keep the top of the test guard clean.

4 **Hold the NITON in one hand.**

Warning: Always treat radiation with respect. Do not put your hand on the end plate of the NITON while measuring. Never point the NITON at yourself or anyone else when the shutter is open.

5 **Push the safety slide** (that locks the shutter release) **out from under the shutter release.** If the slide is still tucked in, you will not be able to press in the release and the instrument will not fit on the test guard correctly.

6 **Place the NITON on the test guard so that the rectangular opening on the test guard is under the window of the NITON.** The back of the unit must be flush with the test guard. Squeeze the shutter release, and firmly press the instrument flat against the surface of the test guard (Figure 3.04 a,b). If you don't squeeze the shutter release, the plunger will not depress. If the plunger is not fully depressed, the window is not fully open and the NITON cannot measure accurately.

Note: **You do not need to squeeze the shutter release continuously while taking a measurement. Hold the NITON firmly against the test guard surface and it will continue to read. Once you lift the instrument, the plunger will back out of the bottom, the shutter will close, and the test will be finished.**

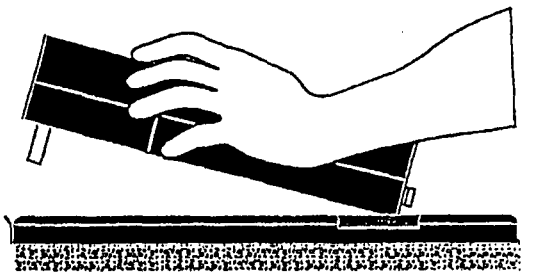


Figure 3.04a
Placing the NITON on the test guard

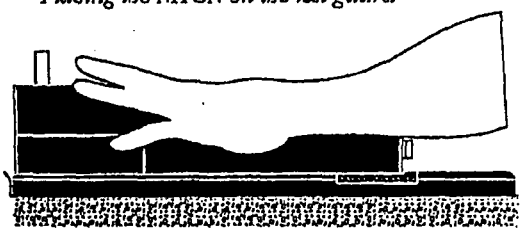


Figure 3.04b
Firmly pressing the NITON flat against the surface

7 Follow the precision indicator ("±") on the NITON screen to see when the test has reached your desired levelof detection and precision.

Warning: In the unlikely event that the plunger gets stuck in the open position, simply push it closed. Then call the NITON Service Department at (401) 294-1234.

In-situ depth profiling

An XRF soil test examines only the top millimeter or so of soil. To do depth profiling, simply remove a vertical slice of soil and test several samples from different depths. Doing so rapidly yields information about the depth of contamination.

Analysis of bagged bulk samples

Sometimes it is convenient to collect samples in plastic bags. Without further preparation of the sample, you can screen the site by testing each bag. Because you are testing through a bag, test results will tend to be 5–10% lower than test results obtained from direct analysis.

Taking bagged samples

1. **Size up the site for differences in soil characteristics before sampling.** Valid results depend on a sufficient and appropriate selection of sites to sample. Consider the site's topography, texture, drainage, color of topsoil, and past use.

2. **Take a composite sample from each predetermined area.** Do not combine samples from areas with different compositions or history. A composite sample made up of samplings from two distinctly different areas is not representative of either area.

3. **Mix the sample.** If it is too large, reduce the sample. Some techniques for reduction and homogenization are described in the section on analysis of prepared samples.

4. **Fill a clean plastic bag with 50–100 grams of soil and close it securely** (with a twist tie). The accuracy of your measurements will be limited by the thickness of the plastic in the bag you use. 1 mil-thick Polyethylene bags offer a reasonable compromise between accurate readings and bag durability. Be sure to label each bag with your name and the location of the sample site.

Testing samples in bags

Shape the bag of soil to form a continuous uniform layer of at least 1 cm. (0.4 inch) thickness. Place the NITON test guard on the bag (Figure 3.05). Then follow in-situ testing instructions from page 5.

Warning: Do not hold bagged bulk samples in your hand during testing.

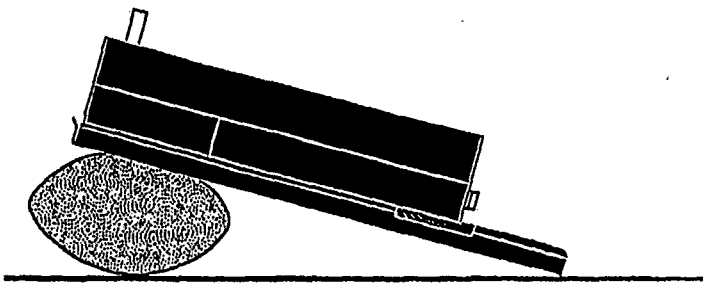


Figure 3.05
NITON Test Guard placed on bag of soil.

Analysis of prepared bulk samples

Prepared sample analysis is the most accurate method for determining the concentration of elements in a bulk medium using your NITON. Sample preparation will minimize the effects of moisture, large particle size and variations in particle size.

Warning: Always use gloves and respiration equipment for your protection when taking samples from a site where toxic chemicals may be present.

NITON recommends a specific sample protocol. See Figure 3.06 for a flow chart of the protocol. Following this protocol for preparing and testing samples is vital for achieving a level of accuracy comparable with laboratory results.

Flow Chart of Sample Preparation Method recommended by NITON.
Use of the #60 Mesh sieve is optional.

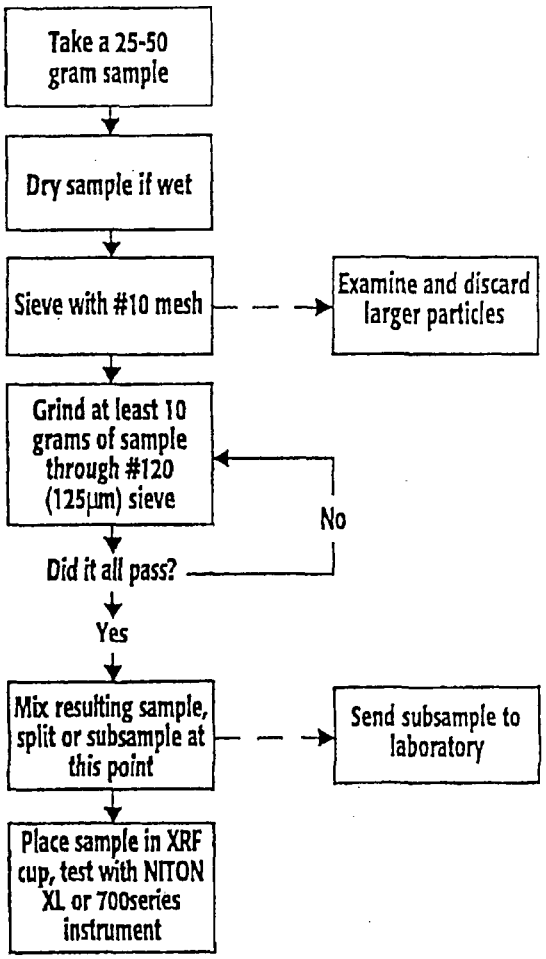


Figure 3.06
Soil Sample Preparation Protocol.
This sample preparation protocol should be followed whenever you are comparing XRF results to laboratory results. Following this protocol is the only way to guarantee that the samples being compared have approximately the same level of contamination present. Without such a preparation protocol there is no basis to compare XRF and laboratory results.

Taking bulk samples

Note: **When testing for lead-in-soil in a residential setting, it is standard practice to sample the top 4 to 6 inches of soil.**

The soil probe or sampling tube is a very convenient sampling tool. because it

- allows speed
- makes more accurate composite samples than any other tool
- may always be inserted to a marked depth and
- removes the same amount of soil at each insertion.

There are core sampling devices that can remove an intact cylinder of undisturbed material.

A shovel, spade, dibble, narrow (1-1/2 inch) garden trowel, or other sampling tool can do the job. Take a half-inch soil slice. A satisfactory soil auger may be made by welding a 1-1/4 or 1-1/2 inch wood bit into a 1/2 inch pipe equipped with a T-handle.

Take 50–100 gram sample to insure that you have a sample large enough to be representative and unbiased after it is mixed, ground, and strained.

1 **Evaluate the area for differences in characteristics before sampling.** The validity of your results will depend on how well your samples represent the test site. Test results may be highly misleading or even worthless unless the samples tested actually represent the area.

Be sure to consider topography, texture, drainage, color of topsoil, and past use when selecting an area. Lead, for instance, is usually concentrated near a building with lead paint (within 4–6 feet).

2 **Reduce the samples by taking a vertical slice** (so it is representative of the entire spadeful) about one inch wide if the individual samplings are taken with spade or trowel (Figure 3.07).

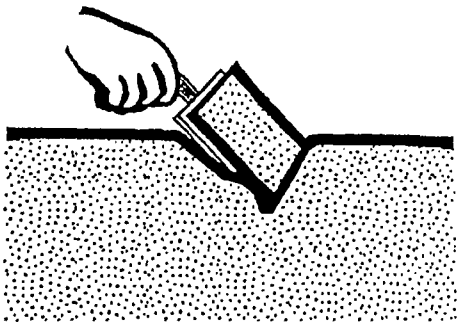


Figure 3.07
Taking a sample with a trowel

3 **Place the reduced samples in a clean pail.** Then mix the sample thoroughly by stirring and by rotating the pail at an angle of 45 degrees. Don't shake—you do not want to stratify the sample by weight).

4 **Take a composite sample from each predetermined area.** Do not combine samples from areas with different compositions or history. A composite sample made up of samplings from two distinctly different areas is not representative of either area.

5 **Prepare a composite sample by** taking several samplings from each predetermined area. These samples should consist of vertical columns of material approximately 1 inch in diameter. The length of each column should be about 6 inches. Lead from paint is usually concentrated within the top 1–4 inches. The elements you wish to measure and the local history will determine the depth at which you need to sample.

Package samples from the following areas in separate categories:

- samples close to painted structures
- samples close to roads
- samples close to where various types of waste have been stored, or
- samples near pressure-treated lumber.

6 **Fill a clean plastic bag and close it securely with a twist tie.** Be sure to label it with the date, the site and the location from which it was taken.

Preparing bulk samples

The equipment you need to prepare samples is included in your kit. Among these are a mortar and pestle (for the 300*Series* with lead-in-soil-analysis), an electrically powered grinding mill (included with 700*Series*), and several sized-sieves.

Caution: All test equipment must be kept clean to prevent contaminated samples.

Cleaning Equipment:

The mortar, pestle, and grinding mill may be cleaned with dry paper towels. You can also clean the mortar, pestle, and the mill's container with water, but be sure each is absolutely dry before using them on another sample. The mortar and pestle may be cleansed by grinding clean dry sand in the mortar. Use the short bristle brushes (included in your Bulk Testing Kit) to clean the sieves. When Soil Grinder blades wear out, unbolt the worn blades and replace. Call the NITON Sales Department at 1-800-875-1578 for replacement blades.

Sample Preparation

To best prepare a sample for presentation to the XRF, the material should be dry and well homogenized. Ideally, the entire sample should be dried to constant weight, sieved to remove gravel and debris, and ground or milled to a fine powder.

1 **Dry the sample if it is moist and cohesive.** The sample can be dried in any of several ways. Choose one of the following:

- **Oven dry** the sample for approximately 2 hours at 150° C, until the sample reaches a constant weight.

  Note: **Oven drying is inappropriate when volatile compounds may be present in the sample.** For example, lead present as tetraethyl lead would be driven off by the heat of drying. Some forms of mercury and arsenic are volatile. Air drying will preserve more of these volatile substances.

- **Air dry** the sample overnight at room temperature in a shallow pan.

- **stir gently and warm the sample in a pan** over a hot plate or burner.

2 **Cone and quartering**

You may need to divide your sample at various times during preparation. Cone and quartering is a method for splitting the sample into homogenous quarters.

- Pour the dry material slowly and carefully onto a flat sheet or pan forming a symmetrical cone.
- Divide the cone into equal piles using a flat thin-bladed tool, such as a knife or ruler.
- Divide these in half again.

Now you have four samples, each one-quarter the size of the original and each more homogenous than the original.

3 **Grind the sample** to break up dirt clods and/or paint chips.

Warning: Grinding-and-sieving dried samples produces dust. Even clean soil contains silica, which may be hazardous when airborne. Prepare all samples in a ventilated area; wear a mask, gloves, and an apron; and spread a drop cloth.

4 **Sieve with the #10 (2mm) mesh and separate out the larger pieces** (stones, organic matter, metallic objects, etc. Examine the larger particles by eye (look for paint chips), but do not include in the sample.

5 **Grind the sample again** so its particles will be finer and more homogenous. Use mortar and pestle, or an electrically powered grinding mill.

6 **Sieve at least 10 grams of the sample through #60 (250 µm) and #120 (125 µm) mesh.** Re-grind the unpassed material until the required fraction is able to pass.

7 **Mix** the resulting sample.

Putting the sample in an XRF sample cup

The container used to hold the sample will affect the accuracy of the measurement. Use a container with as thin-walled a window as is convenient and use the same kind of container and window for each sample. Consistency and careful attention to detail are keys to accurate measurement.

Note: **The sample container should be a sample cup of a type that can be filled from the rear; that is, the side opposite the window (e.g. Chemplex #1330). NITON recommends using a 1/4 mil mylar film (Figure 3.08). A supply of cups and films are included.**

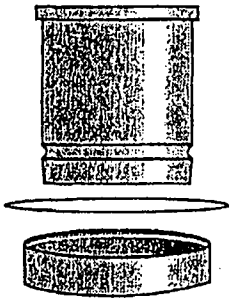


Figure 3.08
Sample cup with 1/4 mil mylar film

1. **Place a circle of mylar film on top of an XRF sample cup.** This film goes on the end of the cup with the indented ring. NITON recommends preparing the cup ahead of time, if possible.

2. **Secure the film with the collar.** The flange inside the collar faces down and snaps into the indented ring of the cup. Inspect the installed film window for continuity and smooth, taut appearance.

3 **Set the cup on a flat surface film-window-side down.** Fill it with at least three grams of the prepared sample (no more than half-full). Take care that there are no voids or layering.

4 **Tamp the sample into the cup.** The end of the pestle makes a convenient tamper. If you intend to re-use the sample, you can, alternatively, place a filter-paper disk on the sample before tamping it.

5 **Fill the rest of the cup with polyester fiber stuffing to prevent sample movement.** Use aquarium filter or pillow filling as stuffing. A small supply of stuffing comes with your bulk sample kit.

6 **Fasten the cap on the cup (Figure 3.09).** Using an indelible pen, write an identifying number on the cup. Keep a record of the sample number, the site and location, the date of the sample, and any other relevant comments.

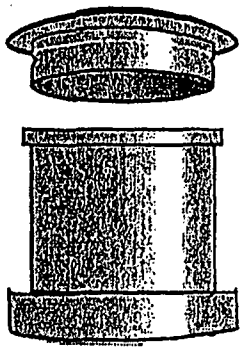


Figure 3.09
Sample cup with cap

Preparing liquids, sludges or dust

Liquids:

Fill an XRF sample cup with the liquid to be tested (Use no cotton). The cup must be full so it is best if some overflows when the cap is put on.

Sludge:

Sludge can be placed directly into an XRF cup for screening. This is considered in-situ testing because no attempt has been made to prepare the sample. For more accuracy, the sludge can be dried, sieved, and ground.

Screening dust:

Vacuum dust with a household vacuum cleaner and use large dust samples taken from the vacuum cleaner bag. Remove fibers, hairs, and debris. At least three grams of dust are needed to assure accurate analysis. Samples as small as one or two grams may be measured with less accuracy. Even smaller samples (0.3 to 1.0 grams) can be analyzed by applying a weight correction factor and by using a funnel to place the sample in the center of the sample cup.

Prepare in an XRF sample cup and test the same way you would with a soil sample. For risk analysis, it is advisable to use a 60-mesh sieve to isolate and test only fine particles.

The bulk testing platform

The test platform (**Figures 3.10a,b**) is an accessory fixture for holding bulk samples (such as soil or ground paint chips) in standard film-window XRF cups. This fixture snaps quickly and securely to your NITON instrument.

The platform latch screws underneath for storage. Before using the test platform, unscrew the latch and rescrew it on the end of the platform nearest the receptacle for the sample cup.

The test stand securely holds the XRF sample cup in place.

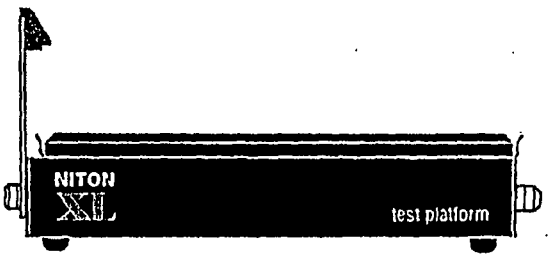


Figure 3.10a
The NITON Test Platform

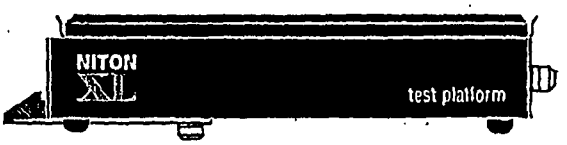


Figure 3.10a
The NITON Test Platform with its latch in the stored position

Testing the sample

Set the NITON test platform on a flat, solid surface. Place the sample cup in the receptacle of the sampler. Included in your kit are some foam disks that you can put in the receptacle under the cup for firmer contact between the NITON and the sample cup window. Attach the NITON to the test stand and follow in-situ bulk sample instructions (**Figures 3.11 a,b**).

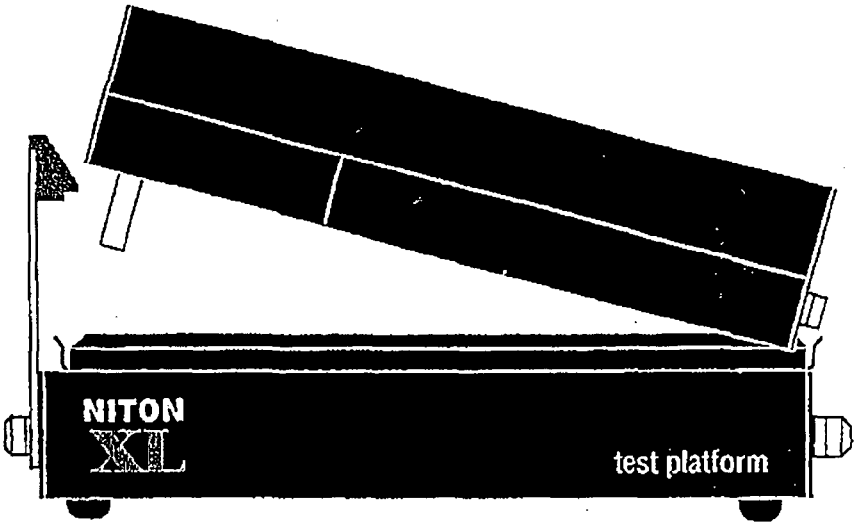


Figure 3.11a
Placing the NITON on the NITON Test Platform

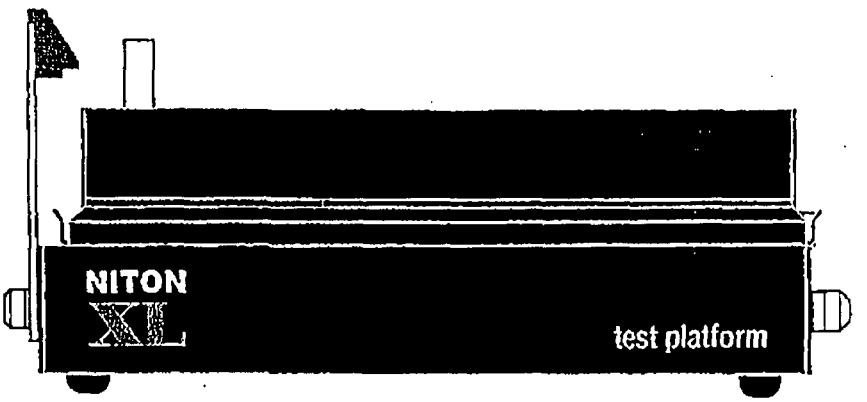


Figure 3.11b
Firmly latching the NITON flat against the NITON Test Platform

Analyzing thin samples

Note: **Remember, turn your NITON on at least 15 minutes prior to testing in Thin Sample Mode. This will give you more precise measurements.**

Overview

The NITON 300*Series* can test dust wipes and other thin samples for lead if it is equipped with optional Dust Wipe Analysis Software and Hardware. The 701, 701A, 703 and 703A Model Analyzers are multi-element analyzers for a wide range of thin samples. Examples of thin samples include:

- 37 mm filters used for exposure monitoring filters, and filters used for Dust Vacuum methods
- Total Suspended Particulate (TSP) and Particulate Monitoring (PM) filters,
- dust wipes,
- filters used for measuring suspended and dissolved metal concentrations in liquids, and
- thin coatings deposited on substrates.

Contamination captured on filters or wipes is not usually deposited uniformly, because the filters and wipes are several times larger that the 1 cm x 2 cm scanning window of the NITON. Therefore, to produce meaningful results, several readings must be taken for each thin sample measurement. Readings are then summed or averaged.

The NITON follows a unique procedure for each application. For example, the procedure for testing dust wipes is different from the procedure for testing 37 mm personal exposure filters. Thus the number of readings, the weight given each reading, and whether the readings are summed or averaged may change for each application. These

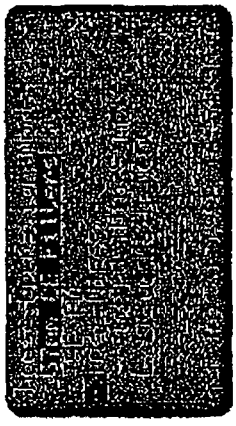


Figure 4.01
Setup Menu.
Thin Sample Mode

choices will be set automatically when you choose the appropriate Thin Sample Mode from the Thin Sample Setup Menu. (See Figure 4.01). *See the section titled "Setup Thin Sample Mode".* This mode should not be used for quantitative lead paint testing.

The dust wipe and filter test platform

The Dust Wipe and Filter Test platform is an accessory fixture for holding 37 mm personal exposure filters, larger contamination monitoring filters, and dust wipes (Figures 4.02, 4.03). The test platform snaps quickly and securely to your NITON—and detaches just as quickly. It also protects you from exposure to radiation.

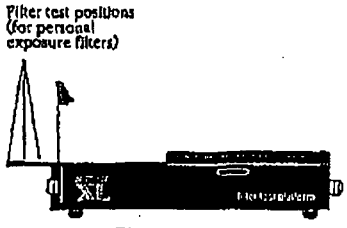


Figure 4.02
The NITON Thin Sample test platform

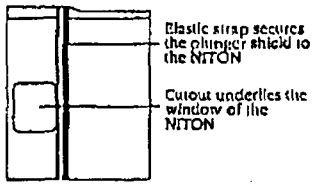


Figure 4.03
The NITON plunger shield protects PM and TSP filters from puncture

The front end of the platform is designed to facilitate testing 37 mm personal exposure filters. The test stand securely holds the filter in place in each of the three test positions required for these filters. The clamp holds the instrument.

To test larger TSP and PM filters, remove the front end of the platform. Use the plunger shield to protect the filter from being punctured by the NITON's plunger. The velcro strap on the filter test platform holds the instrument in place and loosens easily to permit you to reposition the filter between each reading.

Before You Test

NITON provides a set of three thin film standards: lead, copper, and iron to check the calibration of the instrument.

Note: **Although the standards do not contain every element our multi-element analyzers test for, when an instrument correctly measures the standards you have have received with your 700, your NITON will correctly measure the other elements.**

Test the standards regularly. NITON recommends testing immediately after the instrument finishes self-calibration. Test the standard samples appropriate to the type of tests you are conducting, and once every 1–2 hours thereafter.

Note: **For defensible Quality Control, keep a record of the time and precision of every calibration, using the bar code system wherever possible.**

Caution: Never tamper with Test Standards. They should not be used unless they are completely intact.

During each test, the NITON looks at the full range of x-ray spectrum and continuously corrects for cross-element interference. Please refer to the section in Chapter 1 on user calibration on standard samples on page 1-14 for further information.

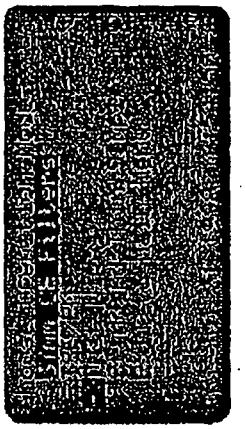


Figure 4.04
Setup Thin Sample Mode: 37mm CE filters

37mm CE and Fiberglass Filter Mode

Before testing 37mm filters

1. access the **Setup Menu**
2. select Setup **Thin Sample Mode**, then
3. select **37mm CE Filters** (**Figure 4.04**).

For details, see the "Setup" and "Setup Thin Sample Mode" section on pp. 1-19 to 1-20.

Preparing a filter

37 mm filters are often used for monitoring personal exposure. Dust vacuum measures (DVM) use the same size filters and are tested in much the same way. To prepare the filter for testing, remove it from the air sampling cassette and load it in a filter sleeve.

The plastic air sampling cassette (**Figure 4.05**) included in your kit is closed-face; an open-faced cassette would be missing the top section and plug. The filter sleeve is a piece of cardboard sandwiched between two layers of thin plastic film (**Figure 4.06**). The cardboard has a circular cutout of slightly larger cutout than the filter.

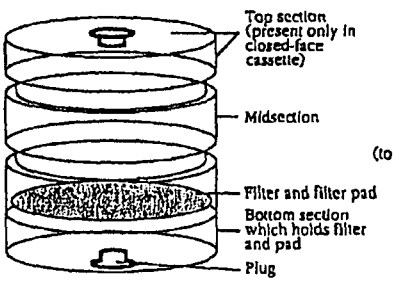


Figure 4.05
An Air sampling cassette

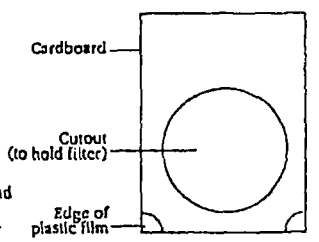


Figure 4.06
Placing the filter in the cardboard filter sleeve for testing

Note: **To avoid contaminating the test results, wear clean surgical gloves. Take a sleeve. Peel back the top layer of film. Set the sleeve down on a clean surface.**

Remove the bottom plug from the air sampling cassette. Separate the sections of the cassette so you can reach the filter. Using tongs, poke the filter and filter pad through the plug hole to release it from its seat in the cassette. Touching only the edges of the filter and pad, gently separate one from the other with your finger. Then, using the tongs, lift the filter from the cassette and place it on the sleeve in the cutout. Close the sleeve. It doesn't matter if the sleeve wrinkles some.

Note: **It is advisable to practice with several blank filter cassettes before using real samples.**

Positioning a filter

Place the sleeve on the test platform. The test platform has a built-in filter holder, designed to hold 37 mm filters securely under the test window of the instrument.

You must take three readings, each from a different area of the filter (**Figure 4.07**) to accurately determine the concentration of elements on the filter. The 300*Series* or 700*Series* will automatically calculate the total loading, in µg, when you complete the three readings. The filter holder has ridges that hold the filter in position for each of the three required readings.

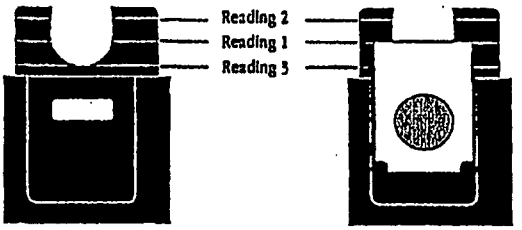


Figure 4.07 (left)
Detailed diagram of filter test platform from above. Note the three test positions

Figure 4.08 (right)
Filter sleeve on the middle position (the first reading) with filter in the sleeve cutout.

Taking a reading

Order is important. You must measure the center of the filter first (Figure 4.08). Place the filter against the middle ridge of the filter holder. This reading is multiplied by a different coefficient than either of the other readings.

1 **Take the first measurement**

a. Set the test platform on a flat, solid surface.

b. Holding the NITON in your hand, place it on the test platform so that the filter is under the test window. Squeeze the shutter release, pull back the latch on the platform with your left hand, and firmly press the instrument flat against the platform surface. You must squeeze the shutter release for the plunger to depress. If the plunger is not fully depressed, the window will not open fully, and the NITON cannot measure accurately. The window opening must be flush with the test platform to get an accurate reading.

The test platform latch will continue to hold the NITON flush against the sample until you lift it off.

Note: **You do not need to hold the NITON or squeeze the shutter release continuously while measuring. Your NITON will continue to test until you lift the instrument from the test platform.**

c. Watch for indications of lead on the screen to decide when the test has reached the desired level of accuracy. The instrument will beep at 60 nominal (or source) seconds, a typical test time for the quantitative measurement of lead.

d. After the desired interval, pull back on the platform latch to release the NITON and lift from the test platform to end the test. The shutter will close automatically. The plunger should be fully extended.

Warning: In the unlikely event that the plunger gets stuck in the open position, simply push it closed. Then call the NITON Service Department at (401) 294-1234.

Note: **Remember, order is important: The middle-of-the-filter reading must be done first.**

2 Slide the filter to the outermost ridge.
Take the **second** measurement (the top of the filter).

3 **Slide the filter to the innermost ridge.**
Take the **third** measurement. The order of these last two measurements may be reversed.

Reading the display

The Measurement screen

The Measurement screen is displayed during each test and is accessible after the test is complete. For the 300*Series*, the screen shows each of the three measurements (in µg/cm²) of lead (Figures. 4.09 a-c).

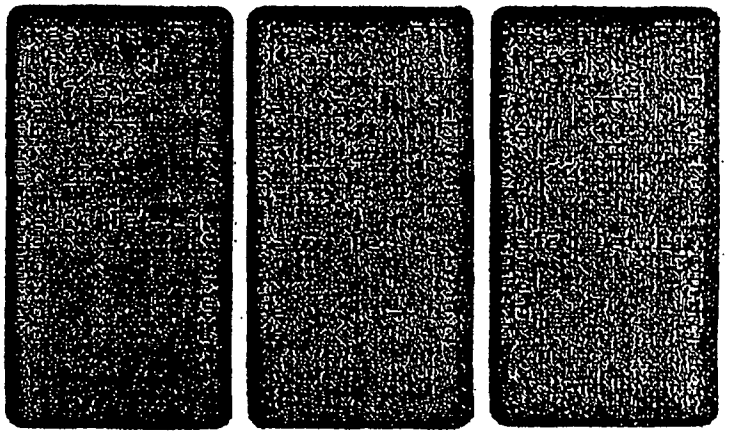


Figure 4.09 a, b, c.
Example of measurement screens for Readings 1, 2, and 3
The 300Series or 700Series instruments will automatically calculate the total loading, in µg, when you complete the three readings

Note: **On multi-element models, the initial Measurement Screens always show lead because lead is the element most commonly measured in Thin Sample mode. The element with the next highest concentration, in µg/cm² is also shown. To see the other elements, press and hold** Clear/Enter **for two seconds. Use the** Arrow buttons **to scroll through the list of results for all elements.**

The Final Result Screen

The **Final Result Screen** (**Figure 4.10**) is displayed only after all three measurements are complete. Final results are in units of µg. On 700*Series* instruments, the screen shows 14 elements, whether they were detected, and how much of each element was detected on the filter (in µg). The **Final Result** screen is automatically given the next reading number.

Figure 4.10 The Final Result Screen showing two parts of the screen. Use the arrow buttons to scroll up or down the screen.

This screen is divided into three parts. The first lists the metals detected. For the 300*Series*, only lead is listed. For the 700*Series*, all of the detected elements are listed, in order of decreasing amounts.

The second part of the screen lists elements where the result was less than the calculated detection limit. The 300*Series* (for lead) and the 700*Series* calculate the detection limit for every sample. Each is shown as being less than a number, representing the detection limit for that element, for that sample. The detection limit is calculated using EPA protocols, that the detection limit is three times the standard deviation.

The third part of the screen lists these same undetected elements displaying for each the weighted sum and twice the standard deviation (95% confidence level) that the instrument calculated.

These three lists will not fit on the Final Results Screen at one time. Use the **Arrow buttons** to scroll up or down the screen.

TSP and PM Filter Mode

TSP and PM filters are often used for air monitoring. They are about 8 x 10 inches in size. The samplers are designed for uniform filter deposition. The purpose of the XRF measurement is to determine total µg of lead and other metals on the filters. Because the samplers are designed for uniform deposition onto the filters, two measurements are taken on these filters. The choice of two measurements is the result of original testing conducted by NITON Corporation, Galson Corporation, and the New York State Department of Transportation (NYSDOT). Because deposition on the filter is presumed uniform, the NITON averages the two readings.

Testing TSP and PM filters on the sampler

One of two methods may be used to test high volume TSP and PM10 filters. The filters can be tested while still mounted on the air sampler (a Graseby sampler, for example), or the filters can be removed from the air sampler and placed on the NITON filter test platform. The official protocol for this procedure is under evaluation by the NYSDOT. At the current time, the favored method is to test with the filters still mounted on the air samplers.

Method 1

This method allows routine measurements of high volume air filters. Validation studies performed by the New York State Department of Transportation utilized hourly tests on the filters. To follow this method:

1. Turn off the pump on the sampler.
2. Place the plunger guard over the NITON. The NITON (with plunger guard) will fit inside of the frame holding the filter. Make sure that the bottom of the guard does not block the window of the NITON.

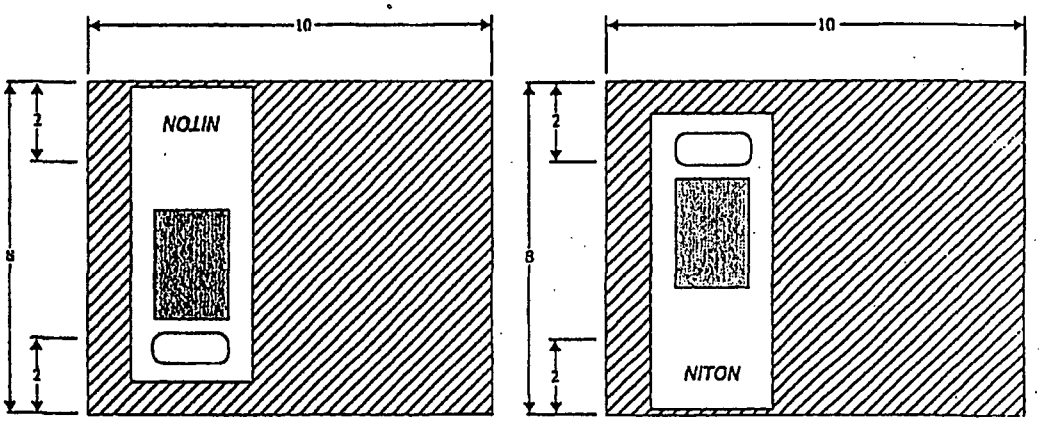


Figure 4.11
Measurement positions for TSP and PM filters for Reading 1 and Reading 2

3 Place the NITON XRF onto one side of the filter, as shown in **Figure 4.11**. It is important to place the NITON onto the first side of the filter without allowing it to touch the other side. This precaution is taken to prevent the NITON from removing any loose dust from the filter.

4 With the instrument in Thin Sample Mode for TSP and PM10 filters, take a 2-minute reading with the XRF in this position. Hold the NITON against the filter for the length of each test. The test will end when you lift the NITON from the filter.

5 Rotate the NITON by 180 degrees and take a second, 2-minute reading

6 The NITON will average the two readings, multiply the average by the area of the filter (404cm²) and report the total number of micrograms of lead, or other metals, present on the filter.

7 Once you have finished testing, clean the capton window at the bottom of the NITON (See page 1-39) to remove any loose dust. The amount of loose dust removed will be generally insignificant compared to the mass of dust on the filter.

Note: **Only test for lead, zinc, and arsenic when testing filters directly on a sampler. The steel grid supporting the filters makes it impossible to measure small concentrations of other elements.**

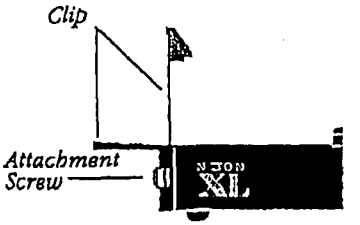
Note: **Initial studies have shown that, after two readings, about 1% to 2% of the lead on a filter is removed from the filter and redeposited on the instrument. To avoid compromising future tests wipe the bottom of the instrument. You may want to have the wipes analyzed.**

Method 2

1 Wear clean surgical gloves.

2 Remove the front end (clip) of the filter test platform (**Figure 4.12**) by loosening the attachment screws.

Figure 4.12
Filter Test Platform
Before testing TSP or PM filters, take off the front part of the test platform by removing the two attachment screws.



3 Place the plunger guard over the NITON. The elastic strap of the plunger guard should be between the buttons and screen of the instrument.

4 Place one corner of filter over the hole in filter test stand (which corresponds to the position of the test window on the NITON). Measure about two inches in from the edge of the contamination on the filter. Take the first measurement.

5 Take one reading from one quadrant of the filter (**Figure 4.12a**). Clean the capton window on the bottom of the instrument (See page 1-40) and test guard after testing each filter.

6 Take a second reading as shown in Figure 4.12a. Your NITON will average the two readings, multiply the average by the area of the filter (404cm²) and report the total number of micrograms of lead, or other metals, present on the filter.

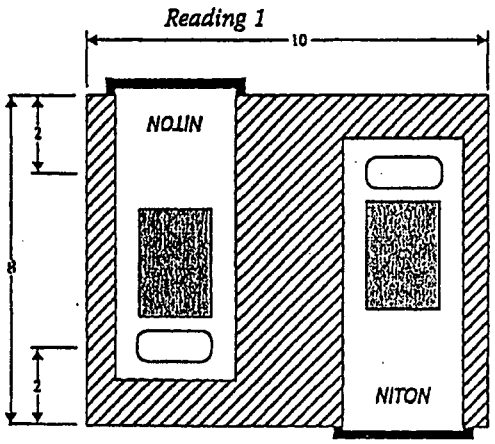


Figure 4.12a
Measurements positions for TSP and PM filters, Method 2

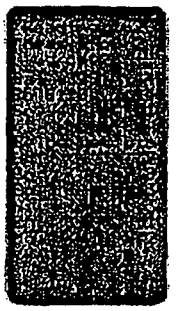


Figure 4.13a Measurement Screen: end of 1st measurement

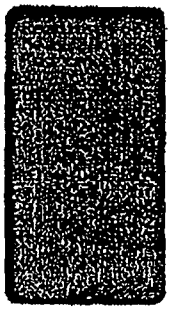


Figure 4.13b Measurement Screen: end of 2nd measurement

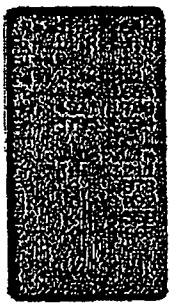


Figure 4.13c Final Result Screen

Reading the display

The Measurement screen

The Measurement Screen is displayed during each test and is accessible after the test is complete. The screen shows each of the two measurements in µg/cm² of lead (**Figure 4.13 a,b**).

When the two measurements are complete, the NITON automatically averages the results to yield the average loading in µg/cm². This average is multiplied by 404 cm² to yield the total lead and other metals, in µg. These results are displayed on the **Final Result** screen (**Figure 4.13c**).

Note: **Even on multi-element analyzers, lead is always displayed on the first screen because lead is the element most commonly measured in Thin Sample mode. To display the next screen, which shows the results for other elements, press and hold** Clear/Enter **for two seconds. Use the** Arrow buttons **to scroll through the list of results for all elements.**

The Final Result screen

The Final Result Screen (**Figure 4.13c**) is displayed only after both measurements are complete. Final results are in units of µg. On 700Series instruments, the screen shows

- 14 elements
- whether they were detected, and
- how much of each element that was detected on the filter (in µg).

The Final Result screen is given the next reading number.

This screen is divided into three parts. The first shows the metals detected. For the 300*Series*, only lead is listed. For the 700*Series*, all of the detected elements are listed, in order of decreasing amounts.

Next is a list of elements where the result was less than the calculated detection limit. Using EPA protocols, the 300*Series* (for lead) and the 700*Series* calculate the detection limit for every sample. The detection limit is three times the standard deviation.

Finally, there is a list of these same undetected elements displaying for each the weighted sum and twice the standard deviation (95% confidence level) that the instrument calculated.

These three lists will not fit on the screen at one time. Use the **Arrow buttons** to scroll up or down the screen.

Other air-monitoring filters

Low-volume air-sampling techniques use 47 mm diameter filters. The NITON can test these as well. The filters are usually very uniform, so taking a single measurement of the center of the filter is a viable option for which you can use the **Standard Thin Sample Mode** (See page 4-21). Results are given in $\mu g/cm^2$. The operator should multiply by the area of the filter to obtain results in μg. Sum or average several readings, or have the results automatically multiplied by using the **User-defineable Thin Sample Mode** to specify a protocol that satisfies your requirements (See page 4-23).

Dust Wipes

This section describes the testing of dust wipes. Dust wipe replacements (part # 187-472) are available from NITON Sales. Please call (800) 875-1578.

NITON has developed a procedure for measuring dust wipes that is currently under review for regulatory approval. The following instructions, therefore, will work for your testing purposes but may be revised as part of the approval process. The NITON displays levels of contamination in µg per wipe. The wipe reflects the contamination of the area wiped. Current regulations require lead contamination below 100 µg/ft² on floors, 500 µg/ft² on window sills, and 800 µg/ft² in window wells.

Note: **For the current software release (Version 5.2) the 300*Series* and 700*Series* provide quantitative results for lead only. You may use the 700 Series for screening of other metals on dust wipes, but element-specific correction factors must be implemented in the firmware to make non-lead measurements quantitative. Please contact NITON regarding timetables for new firmware releases that will offer this feature.**

Taking a Dust Wipe Sample

NITON assumes that the operator will follow the HUD guidelines for taking a dust wipe that are summarized here in Steps 1-4 below:

1. Measure a known area of the surface, preferably one square foot
2. Wear clean surgical gloves. Wipe the measured square with parallel strokes
3. Fold the wipe in half. Wipe in strokes 90° to the original direction.
4. Fold the wipe in half again.

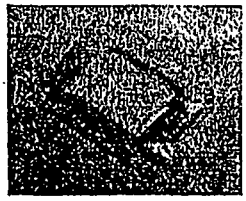


Figure 4.15a
Dust wipes in plastic baggie

For more information on taking dustwipes, please refer to "*Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*," Chapter 7.

Now, follow Steps 6-7 to prepare the wipe for testing with your NITON.

5. Fold the wipe in half three more times (**Figure 4.14**). You will now have a pad measuring about 1 x 1.5 inches (2.5 x 3.7 cm). **It is important to fold the wipe neatly, so that the final wipe is very nearly a neat square measuring about 1 x 1.5 inches.**
6. Place the folded wipe in one of the plastic baggies provided (**Figure 4.15a**).
7. Position the wipe, in the baggie, in the metal dust wipe holder (**Figure 4.15b**).

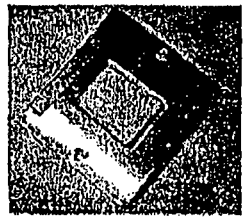


Figure 4.15b
Metal Dust Wipe holder

The dust wipe is now ready to test. NITON recommends that the plastic bags NOT be re-used, to eliminate the chance of cross-contamination of subsequent wipes.

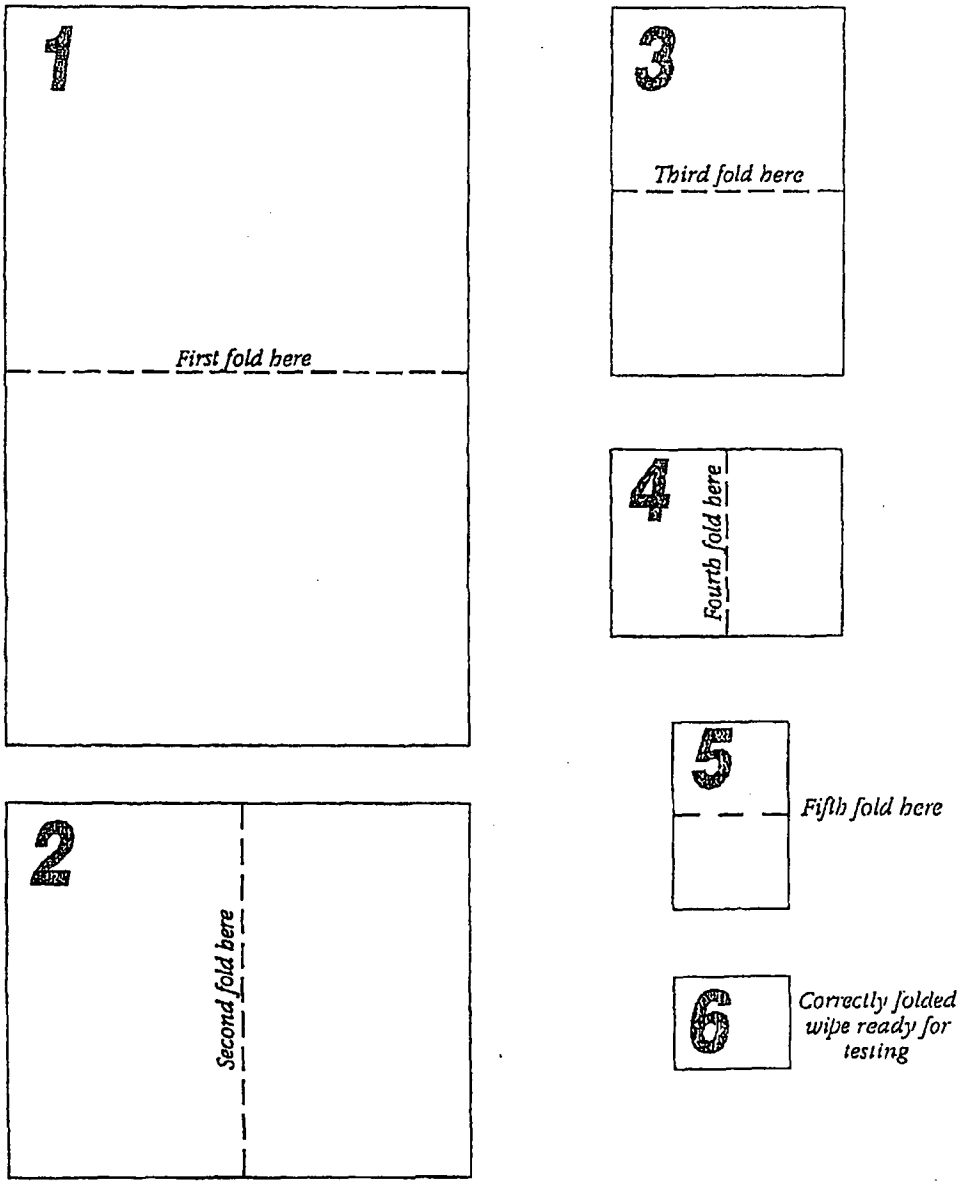


Figure 4.14
Dust wipe folding. Start at the top left and proceed as shown, making five folds

Taking Measurements of Your Dust Wipe Sample

Following the procedure below (Figure 4.16a,b,c,d), take four measurements:

1. Position the metal dust wipe holder on the number one position of the test stand.
2. Take the first measurement.
3. Place the wipe in the number two position of the test stand. Take the second measurement.
4. Rotate the dust wipe holder 180 degrees (without turning the holder over).
5. With the wipe in the number one position, take the third measurement.
6. Change the wipe to the number two position. Take the fourth measurement.

This procedure assures that the entire area of the folded dust wipe is measured by the analyzer.

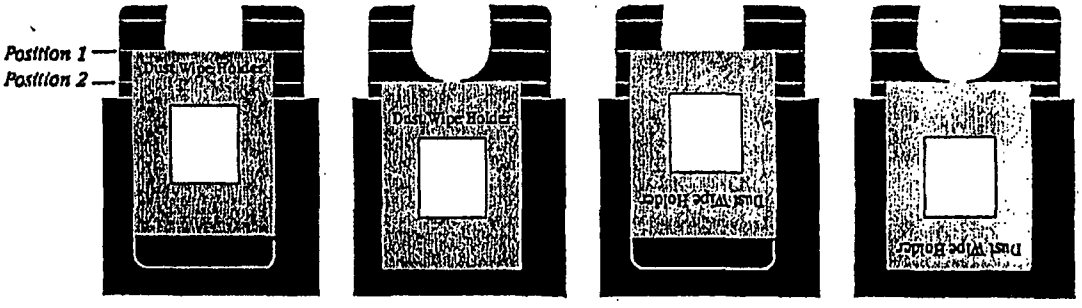


Figure 4.16a Filter test Platform Dust wipe in 1st position

Figure 4.16b Filter test Platform Dust wipe in 2nd position

Figure 4.16c Filter test Platform Dust wipe in 3rd position

Figure 4.16d Filter test Platform Dust wipe in 4th position

Taking a reading

Follow the procedures for **Taking a Reading** for 37mm Filters (See Page 4-6).

Reading the display

The Measurement screen

The Measurement Screen is displayed during each test and is accessible after each test is complete. For the 300*Series*, the screen will show each of the four measurements in µg/cm² of lead (**Figure 4.17a-d**). When all four measurements are complete, the NITON will automatically sum the four test results to achieve the correct reading. This result is given in the **Final Result** screen (**Figure 4.17e**).

Note: **For all 700Series instruments, only two elements will be displayed on the first screen: lead and the element with the highest concentration (other than lead).**

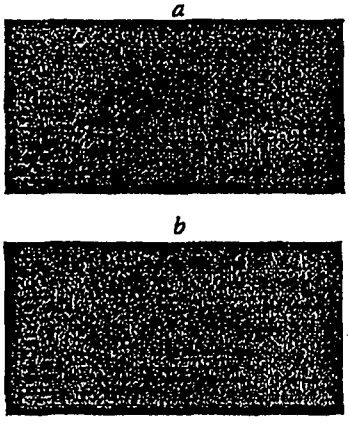


Figure 4.17 a-d
Examples of measurement screens: Dust Wipe measurements

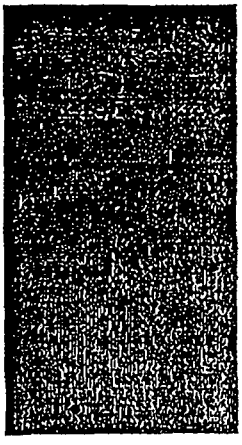


Figure 4.17e
Final Result Screen: Dust Wipes

To display the next screen, which shows the results for other elements, press and hold **Clear/Enter** for two seconds. Use the **Arrow buttons** to scroll through the list of results for all elements.

The Final Result screen

The Final Result Screen (**Figure 4.17e**) is displayed only after all four measurements are complete. Final results are in units of µg. On 700Series instruments, the screen will show 14 elements, whether or not they were detected, and how much of each detected element was present on the filter (in µg). The Final Result screen is given the next consecutive reading number after the last Measurement Screen number.

The Final Result Screen is divided into three lists.

The first list shows the metals detected. For the ***300Series***, only lead is listed. For the ***700Series***, all of the detected elements are listed, in order of decreasing amounts.

The second list is a list of elements where the result was less than the calculated detection limit. The ***300Series*** (for lead) and the ***700Series*** calculate the detection limit for every sample. Each detection limit is shown as being less than a number, representing the detection limit for that element, for that sample. The detection limit is calculated using EPA protocols—three times the standard deviation.

Finally, there is a list of the same undetected elements as those on the second list, displaying for each the weighted sum and twice the standard deviation (95% confidence level) that the instrument calculated.

Note: **These three lists will not fit on the screen at one time. Use the Arrow buttons to scroll up or down the screen.**

Standard Thin Sample Mode

The **Standard Thin Sample Mode** should be used to test thin samples that have uniform contamination or deposition. These include many filters for liquids and gases, various types of coatings, and the leaves of plants. Operators who want to make a single measurement and obtain a result in units of µg/cm² should use Standard Thin Sample Mode.

Caution: The Standard Thin Sample Mode should not be used for quantitative lead-paint testing. Use only the three Paint Testing modes to test lead-based paint.

In the Standard Thin Sample Mode, each measurement is a separate test. For this reason, there is no **Final Result** screen in this mode. The results of each test are given in µg/cm² for lead only (*300Series*) or for up to 14 elements (*700Series*).

Note: **Using Standard Thin Sample Mode to test any coating may yield lower-than-actual test results.**

Standard Thin Sample Mode does not correct for shielding caused by the presence of overlaying coatings. Thus, for coatings testing, the results should be viewed as the *minimum* amount of contaminants present. If an element is not detected, it may be that the element is present but entirely shielded by overlaying coatings.

Beware: Do not rely on negative results when test testing paints and other coatings in this mode.

The Measurement Screen

The **Measurement Screen** is displayed during each test and is accessible after each test is complete. For the 300*Series*, the screen shows the measurements in µg/cm² of lead (**Figure 4.18**). For the 700*Series* the screen displays lead and the element with the highest concentration other than lead, in µg/cm². When the measurement is concluded, the display will change to show all the elements, in µg/cm² (**Figure 4.19**). Use the **Arrow buttons** to scroll through the list of elements.

The Measurement screen is divided into three lists.

The first list shows the metals detected. For the 300*Series*, only lead is listed. For the 700*Series*, *all* of the detected elements are listed, in order of decreasing amounts.

The second list is of those elements where the result was less than the calculated detection limit. Both the 300*Series* (for lead) and the 700*Series* calculate the detection limit for every sample. Each is shown as being less than a number, representing the detection limit for that element, for that sample. The detection limit is calculated using EPA protocols—three times the standard deviation.

The third list shows these same undetected elements, displaying for each the weighted sum and twice the standard deviation (95% confidence level) that the instrument calculated.

Note: **In Standard Thin Sample mode all results are in units of µg/cm².**

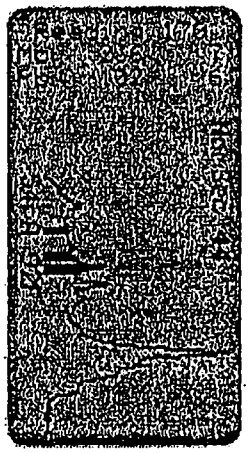


Figure 4.18
Measurement Screen
Standard
Thin Sample Mode

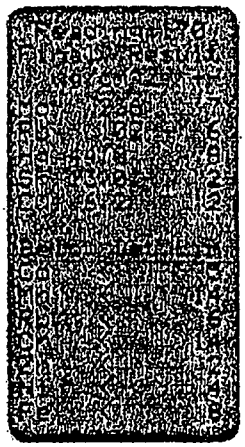


Figure 4.19
Final Result Screen
Standard
Thin Sample Mode

User-definable Thin Sample Testing

User-definable Thin Sample Mode allows you to set up your own protocol for testing thin samples. The user can define the number of measurements that constitute a set, the coefficient applied to each, and whether the measurements are to be summed or averaged.

Specifying a Protocol

When you select User-Definable from the **Setup Thin Sample Mode menu**, the screen (**Figure 4.20a**) will be displayed. Using this screen's setup menu, you can customize how readings are summed or averaged for a particular application—your choice of up to 9 readings.

In most custom applications, where deposits on a thin sample are not uniformly spread across the sample, readings should be averaged or summed.

Note: **When you select the User-Definable mode, the configuration you enter will be saved in the NITON's memory. the last configuration entered will be recalled.**

To Define a Protocol:

- **Avg or Sum:**

  1. Use the **Arrow buttons** to select either Avg or Sum.
  2. Press **Clear/Enter.** Your choice will be shaded. If Avg is chosen, your NITON will average the number of readings you have specified. If Sum is chosen, the number of readings specified will be summed instead of averaged

- **# readings:** To tell the instrument how many readings to use when calculating an average or sum:

  1. Use the **Arrow buttons** to increase or decrease the number of readings you wish to average or sum.
  2. Press **Clear/Enter**. The number must be between 1 and 9.

- **Range:** This field allows the operator to set the numeric range of the coefficents, from 0.0001 to 9999. **You must use the same range for all coefficients.**

  1. Set the decimal place by using the **Arrow buttons**. The decimal place determines the range of possible values for the coefficients.
  2. When the decimal place is set, press **Clear/Enter.**

- **Coefficients:**
  To set coefficients:

  1. Enter each coefficient.
  2. Moving from left to right, set the value of each digit that constitutes the coefficient by using the **Arrow buttons.**
  3. Press **Clear/Enter** to move to the next digit to the right. To move to the next digit without changing the current digit, press **Clear/Enter.**
  4. Repeat this process until every digit of the coefficient has been set.

5 After every digit has been set, press **Clear/Enter** to move to the next coefficient.

6 When finished with the last coefficient, press **Clear/Enter** to return to the **Main Menu**.

By setting coefficients, you can calculate a *weighted sum*, in which the result of each reading is multiplied by the coefficient entered for that reading. For a simple (un-weighted) sum, set each coefficient to 1.0. All unused coefficients should be set to 0.0 (0.0 is the **default** setting).

7 From the **Main Menu**, enter Calibrate and Test. When the NITON is finished self-calibrating, you may begin testing.

Note: **The units of measurement will be determined by the coefficients you have chosen. In "User-Definable" Mode, the units are not necessarily** µg.

Example:

Suppose you would like to perform a weighted sum of three consecutive measurements, using the formula:

(2.800 x Measurement 1) + (4.5 x Measurement 2) + (1.2 x Measurement 3)

The screen for setting up the protocol should appear as follows:

Sum .
# of Rdgs = 3
Range: X.XXX
Coef 1: 2.800
Coef 2: 4.500
Coef 3: 1.200

Note: **In User-Definable Thin Sample mode, you must take exactly the number of readings that you have specified for each test in this mode before proceeding to the next test.**

When you conclude each measurement within the protocol, the analyzer will display the results, in $\mu g/cm^2$ (Figure 4.20a). When the protocol is complete, the analyzer will display a Final Result screen (Figure 4.20b).

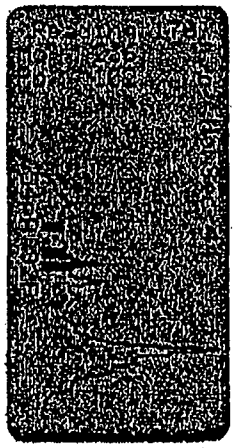


Figure 4.20a
Measurement Screen
Standard
Thin Sample Mode

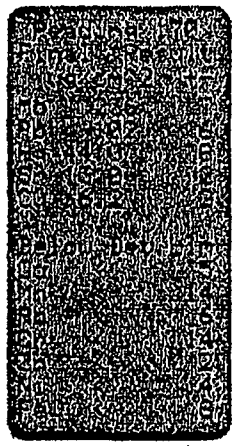


Figure 4.20b
Final Result Screen
Standard
Thin Sample Mode

Analyzing lead paint

Overview

Note: **You do not need the 15-minute warmup to test in lead paint mode.**

The three **Paint Test Modes** are standard on NITON 300*Series*, 701-A, 702-A and 703-A Spectrum Analyzers.

Caution: The Standard Thin Sample Mode (on 701, 701-A, 703 and 703-A analyzers, and available as an option on 300*Series*) should not be used for quantitative lead-paint testing. Use only the three Paint Testing Modes (on 701-A, 702-A, 703-A, and 300*Series* analyzers) to test lead-based paint.

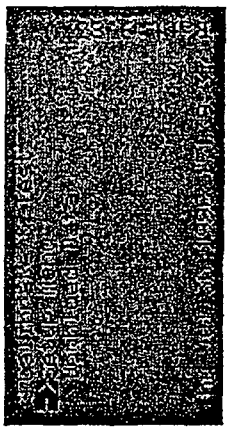


Figure 5.01
Main Menu:
Setup Menu

Getting started in Paint Mode

1. Turn on your NITON Analyzer
2. Use the **Arrow buttons** to select Setup menu from the **Main menu**. Press **Clear/Enter** (**Figure 5.01**).
3. Use the **Arrow buttons** to select Setup Paint mode from the **Setup menu**. Press **Clear/Enter** (**Figure 5.02**).
4. If you do not want to change the **Action-level** or ***beep* time** settings, go to *step 5*. If they are not changed, the NITON will default to the last settings entered.

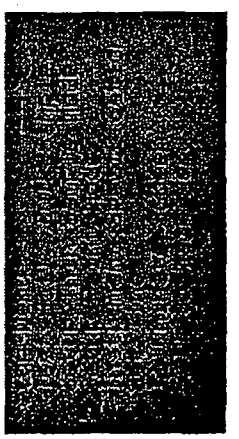


Figure 5.02
Setup Menu:
Setup Paint Mode

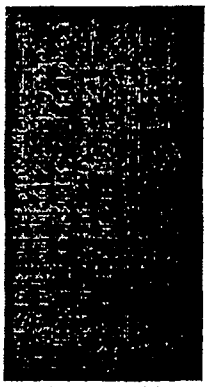


Figure 5.03
Paint Protocol Screen

If you do want to change the settings, enter Setup Paint Protocol from the **Setup Paint screen**. The **Setup Paint Protocol screen** allows you to set the **Action-level** and ***beep*** **times (Figure 5.03)**. When you have set the paint protocol, the instrument will return automatically to the **Setup Paint** screen.

5

From the **Setup Paint** screen (**Figure 5.04**), select one of the three paint testing modes: **Standard Paint Mode, Standard Mode + Spectra** or **K & L Readings + Spectra**. When you have selected a paint testing mode, the instrument will return automatically to the **Main Menu**.

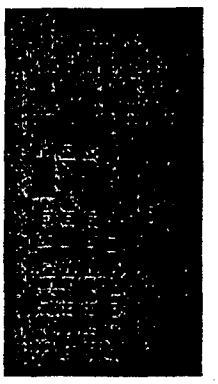


Figure 5.04
Setup Paint Screen

6

Select **Calibrate and Test.** The instrument will then initiate its auto-calibration sequence. This will take one to two minutes. When calibration is complete, the instrument will beep and display the **Ready to Test** screen for whichever of the three paint modes you selected in *Step 5* (**Figure 5.05**). The **Ready to Test** screen will display

- the paint testing mode you have selected
- the date and time,
- the instrument serial number
- the action-level
- the instrument energy resolution, and
- the current source strength.

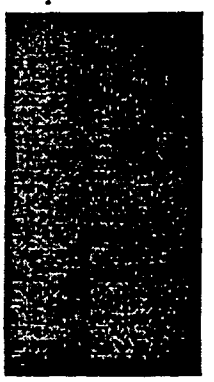


Figure 5.05
Ready to Test:
Standard Paint Mode

Caution: Check the Date **and** Time **displayed on the Ready to Test screen. If they are not correct, reset them before taking any measurements. Your readings will not be accurate unless the date and time are correct.**

Before you test

User Calibration on Standard Lead Paint Samples

NITON provides a set of government-traceable lead paint films for Lead Paint Testing Mode. These are used to check the calibration of the instrument.

Test the paint Standards frequently. NITON recommends testing immediately after the instrument finishes self-calibration, and once every 1–2 hours thereafter.

Note: **For defensible Quality Control, keep a record of the time and precision of every calibration, using the bar code system wherever possible.**

Warning: Keep all standards out of reach of children.

Caution: Never tamper with Test Standards. They should not be used unless they are completely intact.

During each test, the NITON looks at the full range of x-ray spectrum and continuously corrects for cross-element interference and, in paint modes, continuously corrects for substrates, comparing K- and L-shell x-rays to determine when a 95% "confident" positive or negative reading vs. the user-set action level is reached.

Lead Paint Standards

1. Set your NITON in K & L +Spectra Mode.

2. Place the NITON standard with the colored side face up. Choose the RED strip labelled 1.0 ± 0.1. Take a reading of that standard. Place the instrument on the standard so that the instrument window is fully on the standard. Your NITON should display a value between 0.9 and 1.2 mg/cm² and should indicate surface lead.

3. Place the same standard with the colored side down so that the instrument window is fully on the standard. Take a reading of the standard (buried beneath the equivalent of 5–6 coats of non-lead paint). Your NITON should still display a value between 0.9 and 1.2 mg/cm2 and should not display Surface lead.

Note: **If your instrument is testing high on Standard samples, check only the surface the Standards are resting on. That surface may contain lead.**

When you test the Standard samples, your instrument should give readings that approximate the certified values. Your instrument should give consistent readings for each sample.

Taking a measurement

Warning: Always treat radiation with respect. Do not put your hand on the end plate of the NITON while measuring. Never point the NITON at yourself or anyone else when the shutter is open.

Caution: When testing the *exterior* of a window sash from the inside of a room, avoid standing in the path of the NITON's radiation beam. The direction of the beam is drawn on the cover of the instrument (Figure 5.06 a,b). It is easier to avoid the radiation beam if you hold the instrument in your right-hand.

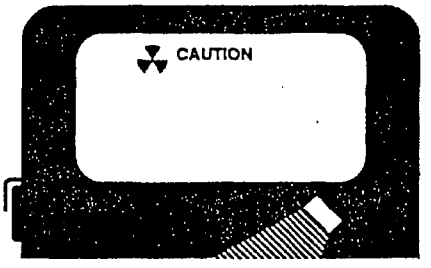


Figure 5.06
Direction of radiation beam shown on NITON cover.

How to take a measurement

1 Push the safety slide (that locks the shutter release) out from under the shutter release. When the slide is in place, you cannot press in the release (**Figure 5.07**).

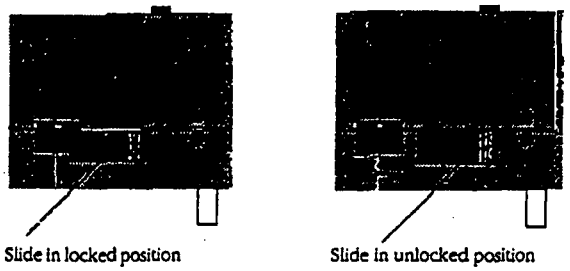


Figure 5.07
Slide lock shown in locked (left) and unlocked (right) positions

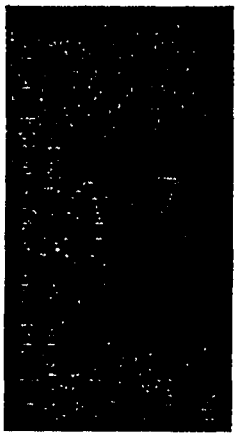


Figure 5.08
Barcode
Data Entry Screen

2 **When you are using the Barcode Data Entry System**: Attach the light pen barcode reader and wrist-mounted bar codes. Flick the **Barcode Reader** across one of the bar codes to display the **Data Entry screen** (**Figure 5.08**). Enter the test location and other test information with the **Barcode Reader**.

3 Place the NITON on the painted surface, squeeze the shutter release, and continue to hold the NITON to the surface you are testing.

Note: The shutter-release trigger must be activated and the window at the back of the instrument must be flush against the surface for instrument to take reliable readings. The instrument must be held against the surface throughout each measurement. You do not need to hold the shutter release continuously.

4 Please refer to **Reading the display (see Page 5-10)** for screen descriptions in each paint mode.

5 When the test is finished, lift the NITON from the surface. The shutter will close automatically.

Warning: In the unlikely event that the plunger gets stuck in the open position, simply push it closed. Then call the NITON Service Department at (401) 294-1234.

6 Your NITON Analyzer can average up to 100 readings at a time. To set up the **Averaging Screen**, hold down the **Clear/Enter** button to toggle through the testing and data entry screens to the **Reading Averaging** screen (**Figure 5.09**). If you select Yes to average readings, you will be prompted to select the number of readings you wish to average. To take additional readings, simply repeat steps 3 through 5. Your NITON will display both the average of the current and previous readings and the number of readings being averaged.

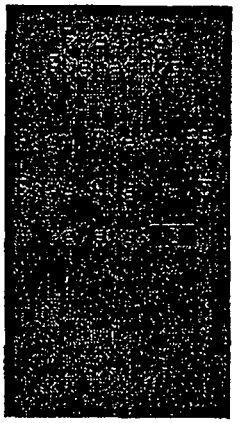


Figure 5.09
Reading Averaging Screen

Using the NITON on flat and curved surfaces

Using your NITON, you can take measurements of almost any surface a child can mouth; only 5/8 inch (1.6 cm) is required.

A sketch of the window is printed on the front of the NITON's case so you can position the instrument properly (**Figure 5.10**) The window of the instrument must be flat against the paint surface or it cannot read properly.

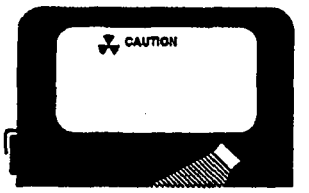


Figure 5.10
Sketch of the front of your NITON

Your NITON Analyzer can accurately measure many curved surfaces. However, you must position the instrument so that its window is flat on the surface. The rest of the instrument doesn't need to lie flat. E.g., on slightly rounded clam shell trim, turn the NITON at right angles to the trim so that its window runs parallel with the length of the trim (**Figure 5.11**). On a cast iron radiator, find a spot against which the NITON's window can lie flat.

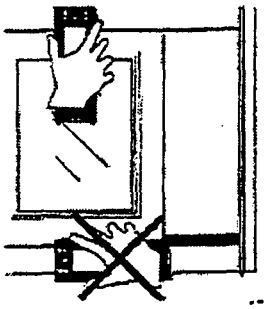


Figure 5.11
Positioning your NITON to measure a clamshell trim

Note: **On *very* highly curved surfaces (such as quarter-round moldings or balusters) the NITON will tend to underestimate the amount of lead present. On very highly curved surfaces, your NITON can only be used to positively identify high concentrations of lead.**

Test Duration

In any of the three paint testing modes, your NITON can measure paint samples in as little as one second. The testing time will depend primarily on the amount of lead in the sample that you are testing compared to the action level you have set. The closer the actual lead concentration in the sample is to the action level, the longer it will take the NITON to make a 95% confident "Positive" or "Negative" determination.

In **Standard Paint Mode** and **Standard Paint Mode + Spectra**, the instrument will measure the paint sample only until a 95% confident reading of "Positive" (greater-than-or-equal-to) or "Negative" (less-than) versus the action-level you have set has been attained. In **K & L + Spectra Mode**, the instrument will also display a "Positive" or "Negative" result and will beep as soon as a 95% confident reading is attained. You then have the option to continue readings until you have achieved a given reading time or degree of precision.

Note: **For all paint testing modes, if you terminate a test *before* a "Positive" or "Negative" determination is attained by the instrument, it will display a "Null" test result.**

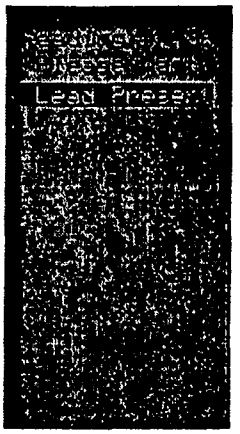


Figure 5.12a
Lead present indicated on the Please Wait Screen

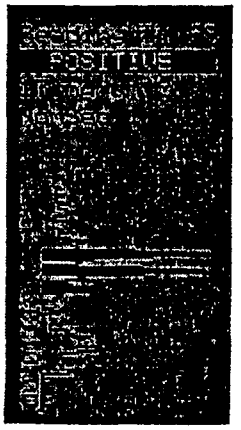


Figure 5.12b
Standard Mode + Spectra

Figure 5.13
Depth Index

Reading the display

In **Standard Paint Mode**, the instrument will display the "Please Wait" message until a 95% confident reading is achieved. When there is lead in the sample, the instrument will indicate **Lead present** on the **Please Wait** screen (**Figure 5.12a**).

When a 95% confident reading is achieved, the instrument will display:

- the reading number
- either a "Positive" or "Negative" reading
- the result in mg/cm²
- the reading time in nominal (source) seconds, and
- the **"Surface Lead"** message for all positive readings where the lead is not shielded by layers of non-leaded paint.

Standard Mode + Spectra is identical to Standard Mode except that the x-ray spectra is displayed with each reading (**Figure 5.12b**).

In **K & L + Spectra Mode**, the instrument will display the following information, updated continuously during each reading:

- the **reading number**
- the **nominal seconds**
- the **L-shell reading** (displayed as L) with the two-sigma confidence interval
- the **K-shell reading** (displayed as K) with the two-sigma confidence interval
- the **combined reading** (displayed as Pb) with the two-sigma confidence interval
- the **full x-ray spectrum**, and
- the **Depth Index** (**Figure 5.13**).

Note: **During each reading in K & L + Spectra mode, *before* a 95% confident Positive or Negative determination has been made, the instrument will display a "Null" test result** (Figure 5.14a). **When a 95% confident determination has been made, the instrument will beep, and the reading classification will switch from** Null **to either** Positive **or** Negative (Figure 5.14b).

Figure 5.14a
"Null" test result

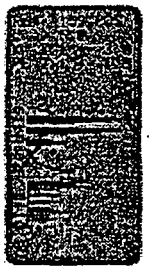


Figure 5.14b
"Positive" test result

The Depth Index (K & L + Spectra mode)

The **Depth Index** (DI) is a numerical indication of the amount of non-leaded paint covering the lead detected by the instrument. The position of the DI on the screen is indicated by an arrow painted on the front of the NITON (**Figure 5.15**). A DI of less than 1.5 indicates lead very near the surface layer of paint. A DI between 1.5 and 4.0 indicates moderately covered lead. A DI greater than 4 indicates deeply buried lead.

Figure 5.15
Depth Index indicated by arrow on case

Averaging readings

Two or more readings may be averaged by specifying the parameters in the **Averaging Screen** (**Figure 5.16**). To start or stop averaging, go to the **Averaging Screen** by holding down the **Clear/Enter** button until the screen appears. You may enter the **Averaging Screen** whenever the instrument is in one of the paint testing modes. Once in the **Averaging Screen**, press **Clear/Enter** *briefly* to move the cursor between lines on the screen. Press the **Arrow buttons** to change averaging parameters. If, for example, you set the # to average at two, subsequent tests will be grouped in twos and averaged.

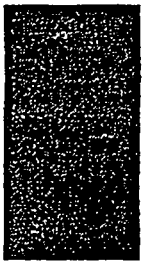


Figure 5.16
Averaging Screen

You may add the next measurement to the current average, by entering **Avg YES**; if you select **Avg NO**, the next reading will not be averaged. Use the **Arrow buttons** to toggle between **Avg YES** and **Avg NO**.

Toggling between paint modes

At any time when a reading is displayed, you may toggle from the paint mode you are in to one of the other paint modes by pressing briefly on the Clear/Enter button one or more times. Press **Clear/Enter** until the paint reading is displayed in the desired paint mode.

Note: **If you hold down the Clear/Enter button continuously, you will toggle from the Paint Testing Mode Result Screen to the SpectraView Screen (standard in 700*Series*, optional for the 300*Series*); the averaging screen; the barcode Data Entry Screen; and back to the Paint Testing Result Screen.**

Note: **Your NITON will continue to take readings in the most recently displayed paint mode until another paint mode is selected. If you scroll to previous readings using the** Arrow buttons, **the instrument will also display the readings in the *current* paint mode being displayed, regardless of the paint mode selected when the readings were taken. Toggle between paint modes after any reading by pressing and holding down the** Clear/Enter **button until the paint mode you want to see appears on the screen.**

Appendix A
Summary of Warnings

Warning: Always treat radiation with respect. Do not put your hand on the end plate of the NITON while measuring. Never point the NITON at yourself or anyone else when the shutter is open.

Warning: Wearing a dosimeter badge does not protect you against current exposure. A dosimeter measures your exposure after the fact. If, at any time, you find measurable exposure, call NITON immediately at (401) 294-1234.

Warning: Pregnant female workers may want to take special precautions to reduce their exposure to radiation. Qualified scientists have recommended that the radiation dose to pregnant women should not exceed 500 mR/year because of possible increased risk to the fetus.

Warning: In the unlikely event that the plunger gets stuck in the open position, simply push it closed. Then call the NITON Service Department at (401) 294-1234.

Warning: Tampering with the 5,500 ppm lead-in-soil standard may cause exposure to lead dust. Keep all standards out of reach of children.

Warning: Always use gloves and respiration equipment for your protection when taking samples from a site where toxic chemicals may be present.

Warning: Grinding and sieving dried samples produces dust. Even clean soil contains silica, which may be hazardous when airborne. Prepare all samples in a ventilated area; wear a mask, gloves, and an apron; and spread a drop cloth.

Warning: Do not hold bagged bulk samples in your hand during testing.

Appendix B
Summary of Cautions

Caution: Do not attempt to make repairs yourself. All Service except exterior cleaning must be performed by NITON Corporation. Any attempt to open your NITON instrument will void the instrument warranty.

Caution: Do not return your NITON without the carrying case. You will void the instrument warranty. You will also be billed for a replacement case plus any repairs resulting from improper shipping.

Caution: Do not return your instrument to NITON without a current leak test. NITON's license prohibits us from repairing or upgrading our instruments without a current leak test certificate. If you return an instrument without a current leak test certificate, NITON will perform a leak test and bill you for the leak test.

Caution: Do not ship your instrument back to NITON for any reason without first notifying NITON Corporation and receiving a Return Authorization Number.

Caution: Do not store the battery packs or battery charger in direct sunlight.

Caution: Do not leave battery packs on the battery charger longer than necessary.

Caution: If the red Temp light comes on repeatedly when a battery pack is on the Battery Charger in the Full Charge cycle, call NITON Customer Service at (401) 294-1234.

Caution: NITON's Nickel Metal Hydride battery packs discharge at a rate of about 2% per day when not in use.

Caution: If you try to calibrate the instrument and it does not calibrate successfully, push the Reset Button on the bottom of the instrument and recalibrate. If your NITON does not calibrate successfully in three attempts, please call the NITON Service Department at (401) 294-1234.

Caution: All user-defined custom barcodes created for use with NITON XRF analyzers must be written in Code 39 (3 of 9) format.

Caution: Check the Date and Time displayed on the Ready to Test screen. If they are not correct, reset them before taking any measurements. Your readings will not be accurate unless the date and time are correct.

Caution: Never tamper with Test Standards. They cannot be used unless they are intact.

Caution: The Standard Thin Sample Mode should not be used for quantitative lead-based paint testing. Use only the three Paint Testing modes to test lead-based paint.

Caution: When testing the *exterior* of the window sash from the inside of a room, avoid standing in the path of the NITON's radiation beam. The direction of the beam is drawn on the cover of the instrument. It is easier to avoid the radiation beam if you hold the instrument in your right-hand.

Caution: Keep all test equipment clean to prevent contaminated samples.

Caution: NITON's license prohibits us from repairing or upgrading any of our XRF instruments without a current leak test certificate. If you return an instrument without a current leak test certificate, NITON will perform a leak test and bill you.

Appendix C
Tips for Better Testing

Define Data Quality Objectives (DQOs)

Before implementing a sampling and analysis program, consider the data quality objectives (DQOs) for the particular site and job. For what purpose is the data being collected? What types of decisions will be made as a result of the data? What are the action-levels for the analytes you are testing at the site? What is known about the extent and distribution of the contaminant? What are the implications of possible mis-classification of samples?

The answers will help to determine the precision and accuracy you need to attain for different phases of the program. These in turn will help you to determine sample-collection procedures, sample preparation methods, sample measurement times, and your requirements for quality assurance and laboratory support.

Standard Operating Procedures

To obtain good test data in your study, it is essential to develop a written Standard Operating Procedure for sampling, measuring, and reporting data. A systematic procedure will help you to produce data of uniform quality. Typically, the Standard Operating Procedure is a written document that details the steps to be taken in handling the samples, standards, equipment, and data, including quality assurance measures, such as calibration checks and laboratory confirmation.

Warm up and calibration checks

All Niton analyzers should be turned on at least 15 minutes prior to testing in **Thin Sample** or **Bulk Sample** modes. This procedure is not necessary in any of the paint testing modes.

Note: **Your instrument should be calibrated before and after testing and at least once per hour during testing.**

Check your instrument by testing **Standard Samples** of known concentration every time you calibrate. Check both a low-level standard (or "blank"),and a high-level standard, (or "spike") of known concentration. Tests of **Standard Samples** should be recorded and kept with the sample test data.

Compare samples *with* and *without* preparation

When testing in Bulk Sample Mode, set aside part of a sample and prepare the rest. Measure both the prepared and the unprepared portions. Differences of up to ±30% of prepared versus unprepared samples are typical.

Send samples to a lab for confirmation

Have some samples measured by atomic absorption spectrophotometry by a certified laboratory. This will verify the correctness of your technique and alert you to any site-specific biases.

Split some samples and analyze each sample with both the XRF and with atomic absorption spectrophotometry in a lab. Your Standard Operating Procedure should specify the number of confirmatory samples (e.g. 10 percent of all samples), what actions will be taken in response to the results, and what records will be kept.

Appendix D
Range, precision and limits

Range of accurate measurement

NITON XRFs are calibrated to give accurate values for most elements in concentrations of 10,000 ppm or less. This is because the linear range of the Compton Normalization Method is from 0 ppm to approximately 10,000 ppm (1%). For actual concentrations of 10,000 ppm to 20,000 ppm (1% to 2%), NITON XRF's may overstate the elemental concentration. For content above 20,000 ppm (2%), readings may exhibit even greater deviation.

It may be possible to develop a calibration curve for a specific sample matrix with a very high concentration of heavy elements. If you wish to measure heavy elements in such matrices, please contact Dr. Don Sackett at NITON Corporation for further information at (781) 275-9275.

95% confidence intervals

The precision of a measurement is expressed as the uncertainty or error of the measured result. For every measurement, the NITON gives an uncertainty range that represents a 95% (or "2-sigma") confidence interval. The 95% confidence interval is the interval between the measured-result-minus-the-uncertainty-range to the measured-result-plus-the uncertainty-range. For example, if you took 100 measurements of a sample, you would expect 95 of the measurements to fall within the 95% confidence interval.

Detection limits (DLs)

The detection limit (DL) is the lowest concentration of analyte in a sample that can reliably be distinguished from zero concentration in a sample. In XRF, the DL is usually defined as three times the standard deviation (sigma) of fluctuation in the background. .
A estimate of the DL can be obtained by measuring a blank standard. Use a standard measurement time (e.g. 60 source seconds). The estimated DL is 1.5 times the two-sigma precision of the measurement.

The method detection limit (MDL) may be a more realistic measure of sensitivity in actual field conditions. The MDL can be determined by replicate analysis of a blank or low level

soil standard. This procedure may be carried out in the laboratory or field. The number of replicate blank measurements should be at least 7. If the replicate blanks are interspersed with the regular measurements as part of the continuing calibration verification (CCV), then the MDL will include the error resulting from instrument drift. Calculate the mean and standard deviation of the replicate measurement series. The bias is the mean minus the standard's known concentration. The MDL is 3 times the standard deviation. The MDL should be reasonably close to the estimated DL. Conservatively, one should report the DL to be the largest value among the estimated DL, MDL, and bias.

In actual usage, a measurement result that exceeds the DL is considered strong evidence of the analyte's presence in the sample. A measurement result that does not exceed the DL for an analyte is reported as "not detected."

Quantitation limit (QLs)

The quantitation limit (QL) is the lowest concentration of analyte that can be reliably measured at high enough precision to allow comparisons among measurements. The XRF industry usually defines QL as 10 times the standard deviation (or "10-sigma") or fluctuation in the background level. QL is therefore 3.33 times the DL. Similarly, the method quantitation limit (MQL) is simply 3.33 times the MDL.

Regulatory bodies often require analytical methods used to establish compliance with a standard or action level to achieve a quantitation limit (QL) equal to or below the standard or action level.

Appendix E
Multi-element analysis (700Series only)

Overview

700Series analyzers can quantify concentrations of many elements. With a cadmium-109 source, the normally displayed elements are: arsenic, barium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, rubidium, strontium, zinc and zirconium. The best detection limits are for molybdenum, rubidium, strontium and zirconium, as well as niobium and yttrium, which are not ordinarily displayed. 700's also have excellent detection limits for lead and mercury, as well as for gold, tungsten and uranium, which are not ordinarily displayed. 700's detect barium, chromium, cobalt, iron, manganese, and nickel with somewhat less sensitivity; the same applies to calcium, scandium, titanium, and vanadium, which are not ordinarily displayed. Finally, 700's detect arsenic, copper and zinc, but there are sometimes problems associated with the measurement of these elements due to cross-element interference. In particular, when zinc and copper are both present in a sample, the element with the higher concentration of the two can be measured more accurately.

Cross-Element Interference

700 Series users should be aware that interference between elements can reduce the sensitivity of the 700 to certain elements in certain situations. Interference occurs when the spectra of two or more elements partially or totally overlap (that is, the elements have nearly identical x-ray flourescent energies).

Note: **All NITON analyzers correct automatically for cross-element interference in all modes. These corrections are performed automatically and continuously, throughout each test.**

NITON instruments correct for these cross-element interferences in all modes. In some instances, however, these corrections will worsen the detection limits and precision of the instrument in **Bulk Sample** and **Thin Sample** modes. For example, in the presence of high concentrations of zinc (>10,000 ppm), the 700 Series analyzer will be unable to detect slight trace concentrations of copper that would be detected if a large amount of zinc was not present. Another example: Very high concentrations of iron (>30,000 ppm) may produce false-positive readings for very small concentrations of manganese and/or cobalt.

Appendix F
Warranty

NITON will warranty parts and labor for any manufacturer's defects for 15 months. No precision instrument is warranted if crushed, dropped on the floor or in a bucket of water. All service, including repair, maintenance and source replacements, must be performed by NITON Corporation. Any attempt to open the metal case of your NITON instrument will nullify this warranty.

Limited Warranty Provision for Use with Purchase and License Agreement for NITON Corporation XRF Detection instruments:

(a) Except as otherwise agreed in writing, NITON Corporation warrants, under normal conditions of operation, each product sold (except for components not of its manufacture) against defects of material and workmanship, provided that such product has been properly utilized. This warranty applies to the original purchaser only and shall commence to run from the date of shipment and shall continue for a period of fifteen (15) months. In any event, NITON Corporation's liability for any such defects of material and workmanship shall not exceed the cost of replacement of defective parts upon timely notification of such defect in writing delivered to NITON Corporation's home office. NITON Corporation shall not be liable for damage or destruction caused during delivery or caused other than by employees of NITON Corporation.

(b) Material, accessories, parts, or items of equipment furnished by suppliers to NITON Corporation and used in the manufacture of NITON Corporation products are guaranteed by NITON Corporation only to the extent of the original manufacturer's express warranty to NITON Corporation for a period not to exceed the warranty period described in paragraph (a) above and provided that the purchaser shall have notified NITON Corporation so as to enable NITON Corporation to avail itself of its rights under such original manufacturer's express warranty.

(c) NITON Corporation shall, at its option, repair such defects or replace the parts or products found defective. All defective parts are to be returned, freight prepaid, immediately to NITON Corporation for inspection and credit. NITON Corporation will make no allowance for repairs or alterations made by the purchaser unless made with the advance written consent of NITON Corporation. NITON Corporation assumes no liability for costs of disassembly of defective parts and equipment. Shipment by purchaser of all repairs and replacements under this warranty are F.O.B. NITON Corporation's factory or authorized service representative and method of shipment will be determined by NITON Corporation. The purchaser will pay shipping costs and insurance in both directions of products, parts, or components shipped for warranty service hereunder. The purchaser will be responsible for risk of loss in both direction. Replaced parts or components will become the property of NITON Corporation. Replacement parts or components may contain recycled, refurbished, or remanufactured parts equivalent to new parts and shall be warranted for the remainder of the original warranty period for the products.

(d) NITON Corporation shall not be liable for delays, deprivation of use, or any other damages, direct or indirect, which may result to the purchaser because of defects in the product or because of the purchaser's inability to operate it or use it to his satisfaction. NITON Corporation will not be liable to anyone for special or consequential damages of any kind. NITON Corporation neither assumes nor authorizes any person to assume for it, any other obligation or liability with respect to NITON Corporation products.

Except for the foregoing express warranty, there are no warranties, representations, or guarantees, express or implied, except as are expressly set forth herein. The foregoing warranty is the only warranty made by NITON Corporation. Any implied warranty of merchantability or fitness for a particular purpose on this product is limited in duration to the two year duration of this written warranty. Some states do not allow limitations on how long an implied warranty lasts or the exclusion of limitation of incidental or consequential damages so the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

Appendix G

X-ray emission energies arranged by element, by atomic number

For elements titanium (22) through molybdenum (42) and elements tellurium (52) through uranium (92)

Element	Symbol	Atomic Number	Weight	Average Energy of X-ray Fluorescence (keV) Kα	Kβ	Lα	Lβ	Lγ
titanium	Ti	22	47.90	4.5	4.9			
vanadium	V	23	50.94	4.9	5.4			
chromium	Cr	24	52.00	5.4	5.9			
manganese	Mn	25	54.94	5.9	6.5			
iron	Fe	26	55.85	6.4	7.1			
cobalt	Co	27	58.93	6.9	7.6			
nickel	Ni	28	58.70	7.5	8.3			
copper	Cu	29	63.55	8.0	8.9			
zinc	Zn	30	65.38	8.6	9.6			
gallium	Ga	31	69.72	9.2	10.3			
germanium	Ge	32	72.59	9.9	11.0			
arsenic	As	33	74.92	10.5	11.7			
selenium	Se	34	78.96	11.2	12.5			
bromine	Br	35	79.90	11.9	13.3			
krypton	Kr	36	83.80	12.6	14.1			
rubidium	Rb	37	85.47	13.4	15.0			
strontium	Sr	38	87.62	14.1	15.8			
yttrium	Y	39	88.91	14.9	16.8			
zirconium	Zr	40	91.22	15.7	17.7			
niobium	Nb	41	92.91	16.6	18.6			
molybdenum	Mo	42	95.94	17.4	19.6			
tellurium	Te	52	127.60	27.4	31.1	3.8	4.0	4.6
iodine	I	53	126.90	28.5	32.4	3.9	4.2	4.8
xenon	Xe	54	131.30	29.7	33.8	4.1	4.4	5.0
cesium	Cs	55	132.91	30.9	35.1	4.3	4.6	5.3
barium	Ba	56	137.33	32.1	36.6	4.5	4.8	5.5
lanthanum	La	57	138.91	33.3	38.0	4.7	5.0	5.8
cerium	Ce	58	140.12	34.6	39.5	4.8	5.3	6.0
praseodymium	Pr	59	140.91	35.9	41.0	5.0	5.5	6.3
neodymium	Nd	60	144.24	37.2	42.5	5.2	5.7	6.6
promethium	Pm	61	(145)	38.5	44.0	5.4	6.0	6.9
samarium	Sm	62	150.35	39.9	45.6	5.6	6.2	7.2
europium	Eu	63	151.96	41.3	47.3	5.8	6.5	7.5
gadolinium	Gd	64	157.25	42.8	48.9	6.1	6.7	7.8

X-ray emission energies arranged by element, by atomic number

(Continued)

Element	Symbol	Atomic Number	Weight	Average Energy of X-ray Fluorescence (keV) Kα	Kβ	Lα	Lβ	Lγ
terbium	Tb	65	158.92	44.2	50.7	6.3	7.0	8.1
dysprosium	Dy	66	162.50	45.7	52.4	6.5	7.2	8.4
holmium	Ho	67	164.93	47.3	54.2	6.7	7.5	8.7
erbium	Er	68	167.26	48.8	56.0	6.9	7.8	9.1
thulium	Tm	69	168.93	50.4	57.8	7.2	8.1	9.4
ytterbium	Tb	70	173.04	52.0	59.7	7.4	8.4	9.8
lutecium	Lu	71	174.97	53.7	61.6	7.7	8.7	10.1
hafnium	Hf	72	178.49	55.4	63.6	7.9	9.0	10.5
tantalum	Ta	73	180.95	57.1	65.6	8.1	9.3	10.9
tungsten	W	74	183.85	58.9	67.6	8.4	9.7	11.3
rhenium	Re	75	186.2	60.7	69.7	8.7	10.0	11.7
osmium	Os	76	190.2	62.5	71.8	8.9	10.4	12.1
iridium	Ir	77	192.2	64.3	73.9	9.2	10.7	12.5
platinum	Pt	78	195.09	66.2	76.1	9.4	11.1	12.9
gold	Au	79	196.97	68.2	78.4	9.7	11.4	13.4
mercury	Hg	80	200.59	70.2	80.7	10.0	11.8	13.8
thallium	Tl	81	204.37	72.2	83.0	10.3	12.2	14.3
lead	Pb	82	207.19	74.2	85.4	10.5	12.6	14.8
bismuth	Bi	83	208.98			10.8	13.0	15.2
polonium	Po	84	(210)			11.1	13.4	15.7
astatine	At	85	(210)			11.4	13.9	16.2
radon	Rn	86	(222)			11.7	14.3	16.8
francium	Fr	87	(223)			12.0	14.8	17.3
radium	Ra	88	(226)			12.3	15.2	17.8
actinium	Ac	89	(227)			12.7	15.7	18.4
thorium	Th	90	232.04			13.0	16.2	19.0
protactinium	Pa	91	(231)			13.3	16.7	19.6
uranium	U	92	238.03			13.6	17.2	20.2

Appendix H

X-ray emission energies arranged by element, alphabetically

Element	Symbol	Atomic No.	Atomic Wgt.	Average Energy of Fluorescence Kα	Kβ	Lα	Lβ	Lγ
actinium	Ac	89	(227)			12.7	15.7	18.4
arsenic	As	33	74.92	10.5	11.7			
astatine	At	85	(210)			11.4	13.9	16.2
barium	Ba	56	137.33	32.1	36.6	4.5	4.8	5.5
bismuth	Bi	83	208.98			10.8	13.0	15.2
bromine	Br	35	79.90	11.9	13.3			
cerium	Ce	58	140.12	34.6	39.5	4.8	5.3	6.0
cesium	Cs	55	132.91	30.9	35.1	4.3	4.6	5.3
chromium	Cr	24	52.00	5.4	5.9			
cobalt	Co	27	58.93	6.9	7.6			
copper	Cu	29	63.55	8.0	8.9			
dysprosium	Dy	66	162.50	45.7	52.4	6.5	7.2	8.4
erbium	Er	68	167.26	48.8	56.0	6.9	7.8	9.1
europium	Eu	63	151.96	41.3	47.3	5.8	6.5	7.5
francium	Fr	87	(223)			12.0	14.8	17.3
gadolinium	Gd	64	157.25	42.8	48.9	6.1	6.7	7.8
gallium	Ga	31	69.72	9.2	10.3			
germanium	Ge	32	72.59	9.9	11.0			
gold	Au	79	196.97	68.2	78.4	9.7	11.4	13.4
hafnium	Hf	72	178.49	55.4	63.6	7.9	9.0	10.5
holmium	Ho	67	164.93	47.3	54.2	6.7	7.5	8.7
iodine	I	53	126.90	28.5	32.4	3.9	4.2	4.8
iridium	Ir	77	192.2	64.3	73.9	9.2	10.7	12.5
iron	Fe	26	55.85	6.4	7.1			
krypton	Kr	36	83.80	12.6	14.1			
lanthanum	La	57	138.91	33.3	38.0	4.7	5.0	5.8
lead	Pb	82	207.19	74.2	85.4	10.5	12.6	14.8
lutecium	Lu	71	174.97	53.7	61.6	7.7	8.7	10.1
manganese	Mn	25	54.94	5.9	6.5			
mercury	Hg	80	200.59	70.2	80.7	10.0	11.8	13.8
molybdenum	Mo	42	95.94	17.4	19.6			

X-ray emission energies arranged by element, alphabetically

(Continued)

Element	Symbol	Atomic No.	Atomic Wgt.	Average Energy of Fluorescence Kα	Kβ	Lα	Lβ	Lγ
neodymium	Nd	60	144.24	37.2	42.5	5.2	5.7	6.6
nickel	Ni	28	58.70	7.5	8.3			
niobium	Nb	41	92.91	16.6	18.6			
osmium	Os	76	190.2	62.5	71.8	8.9	10.4	12.1
platinum	Pt	78	195.09	66.2	76.1	9.4	11.1	12.9
polonium	Po	84	(210)			11.1	13.4	15.7
praseodymium	Pr	59	140.91	35.9	41.0	5.0	5.5	6.3
promethium	Pm	61	(145)	38.5	44.0	5.4	6.0	6.9
protactinium	Pa	91	(231)			13.3	16.7	19.6
radium	Ra	88	(226)			12.3	15.2	17.8
radon	Rn	86	(222)			11.7	14.3	16.8
rhenium	Re	75	186.2	60.7	69.7	8.7	10.0	11.7
rubidium	Rb	37	85.47	13.4	15.0			
samarium	Sm	62	150.35	39.9	45.6	5.6	6.2	7.2
selenium	Se	34	78.96	11.2	12.5			
strontium	Sr	38	87.62	14.1	15.8			
tantalum	Ta	73	180.95	57.1	65.6	8.1	9.3	10.9
tellurium	Te	52	127.60	27.4	31.1	3.8	4.0	4.6
terbium	Tb	65	158.92	44.2	50.7	6.3	7.0	8.1
thallium	Tl	81	204.37	72.2	83.0	10.3	12.2	14.3
thorium	Th	90	232.04			13.0	16.2	19.0
thulium	Tm	69	168.93	50.4	57.8	7.2	8.1	9.4
titanium	Ti	22	47.90	4.5	4.9			
tungsten	W	74	183.85	58.9	67.6	8.4	9.7	11.3
uranium	U	92	238.03			13.6	17.2	20.2
vanadium	V	23	50.94	4.9	5.4			
xenon	Xe	54	131.30	29.7	33.8	4.1	4.4	5.0
ytterbium	Yb	70	173.04	52.0	59.7	7.4	8.4	9.8
zinc	Zn	30	65.38	8.6	9.6			
zirconium	Zr	40	91.22	15.7	17.7			

Appendix I

X-ray emission energies arranged by element, by increasing energy (keV)

keV	Element	Symbol	keV	Element	Symbol	keV	Element	Symbol
3.8	tellurium	Te	6.2	samarium	Sm	8.7	lutecium	Lu
3.9	iodine	I	6.3	terbium	Tb	8.7	holmium	Ho
4.0	tellurium	Te	6.3	praseodymium	Pr	8.9	copper	Cu
4.1	xenon	Xe	6.4	iron	Fe	8.9	osmium	Os
4.2	iodine	I	6.5	manganese	Mn	9.0	hafnium	Hf
4.3	cesium	Cs	6.5	dysprosium	Dy	9.1	erbium	Er
4.4	xenon	Xe	6.5	europium	Eu	9.2	gallium	Ga
4.5	titanium	Ti	6.6	neodymium	Nd	9.2	iridium	Ir
4.5	barium	Ba	6.7	holmium	Ho	9.3	tantalum	Ta
4.6	cesium	Cs	6.7	gadolinium	Gd	9.4	platinm	Pt
4.6	tellurium	Te	6.9	cobalt	Co	9.4	thulium	Tm
4.7	lanthanum	La	6.9	erbium	Er	9.6	zinc	Zn
4.8	cerium	Ce	6.9	promethium	Pm	9.7	gold	Au
4.8	barium	Ba	7.0	terbium	Tb	9.7	tungsten	W
4.8	iodine	I	7.1	iron	Fe	9.8	ytterbium	Yb
4.9	vanadium	V	7.2	thulium	Tm	9.9	germanium	Ge
4.9	titanium	Ti	7.2	dysprosium	Dy	10.0	mercury	Hg
5.0	praseodymium	Pr	7.2	samarium	Sm	10.0	rhenium	Re
5.0	lanthanum	La	7.4	ytterbium	Yb	10.1	lutecium	Lu
5.0	xenon	Xe	7.5	nickel	Ni	10.3	gallium	Ga
5.2	neodymium	Nd	7.5	holmium	Ho	10.3	thallium	Tl
5.3	cerium	Ce	7.5	europium	Eu	10.4	osmium	Os
5.3	cesium	Cs	7.6	cobalt	Co	10.5	arsenic	As
5.4	chromium	Cr	7.7	lutecium	Lu	10.5	lead	Pb
5.4	vanadium	V	7.8	erbium	Er	10.5	hafnium	Hf
5.4	promethium	Pm	7.8	gadolinium	Gd	10.7	iridium	Ir
5.5	praseodymium	Pr	7.9	hafnium	Hf	10.8	bismuth	Bi
5.5	barium	Ba	8.0	copper	Cu	10.9	tantalum	Ta
5.6	samarium	Sm	8.1	tantalum	Ta	11.0	germanium	Ge
5.7	neodymium	Nd	8.1	thulium	Tm	11.1	polonium	Po
5.8	europium	Eu	8.1	terbium	Tb	11.1	platinum	Pt
5.8	lanthanum	La	8.3	nickel	Ni	11.2	selenium	Se
5.9	manganese	Mn	8.4	tungsten	W	11.3	tungsten	W
5.9	chromium	Cr	8.4	ytterbium	Yb	11.4	astatine	At
6.0	promethium	Pm	8.4	dysprosium	Dy	11.4	gold	Au
6.0	cerium	Ce	8.6	zinc	Zn	11.7	arsenic	As
6.1	gadolinium	Gd	8.7	rhenium	Re	11.7	radon	Rn

X-ray emission energies arranged by element, by increasing energy (keV)

(Continued)

keV	Element	Symbol
11.7	rhenium	Re
11.8	mercury	Hg
11.9	bromine	Br
12.0	francium	Fr
12.1	osmium	Os
12.2	thallium	Tl
12.3	radium	Ra
12.5	selenium	Se
12.5	iridium	Ir
12.6	krypton	Kr
12.6	lead	Pb
12.7	actinium	Ac
12.9	platinum	Pt
13.0	thorium	Th
13.0	bismuth	Bi
13.3	bromine	Br
13.3	protactinium	Pa
13.4	rubidium	Rb
13.4	polonium	Po
13.4	gold	Au
13.6	uranium	U
13.8	mercury	Hg
13.9	astatine	At
14.1	strontium	Sr
14.1	krypton	Kr
14.3	radon	Rn
14.3	thallium	Tl
14.8	francium	Fr
14.8	lead	Pb
14.9	yttrium	Y
15.0	rubidium	Rb
15.2	radium	Ra
15.2	bismuth	Bi
15.7	zirconium	Zr
15.7	actinium	Ac
15.7	polonium	Po
15.8	strontium	Sr
16.2	thorium	Th
16.2	astatine	At
16.6	niobium	Nb
16.7	protactinium	Pa
16.8	yttrium	Y
16,8	radon	Rn
17.2	uranium	U
17.3	francium	Fr
17.4	molybdenum	Mo
17.7	zirconium	Zr
17.8	radium	Ra
18.4	actinium	Ac
18.6	niobium	Nb
19.0	thorium	Th
19.6	molybdenum	Mo
19.6	protactinium	Pa
20.2	uranium	U
27.4	tellurium	Te
28.5	iodine	I
29.7	xenon	Xe
30.9	cesium	Ce
31.1	tellurium	Te
32.1	barium	Ba
32.4	iodine	I
33.3	lanthanum	La
33.8	xenon	Xe
34.6	cerium	Ce
35.1	cesium	Cs
35.9	praseodymium	Pr
36.6	barium	Ba
37.2	neodymium	Nd
38.0	lanthanum	La
38.5	promethium	Pm
39.5	cerium	Ce
39.9	samarium	Sm
41.0	praseodymium	Pr
41.3	europium	Eu
42.5	neodymium	Nd
42.8	gadolinium	Gd
44.0	promethium	Pm
44.2	terbium	Tb
45.6	samarium	Sm
45.7	dysprosium	Dy
47.3	holmium	Ho
47.3	europium	Eu
48.8	erbium	Er
48.9	gadolinium	Gd
50.4	thulium	Tm
50.7	terbium	Tb
52.0	ytterbium	Yb
52.4	dysprosium	Dy
53.7	lutecium	Lu
54.2	holmium	Ho
55.4	hafnium	Hf
56.0	erbium	er
57.1	tantalum	Ta
57.8	thulium	Tm
58.9	tungsten	W
59.7	ytterbium	Yb
60.7	rhenium	Re
61.6	lutecium	Lu
62.5	osmium	Os
63.6	hafnium	Hf
64.3	iridium	Ir
65.6	tantalum	Ta
66.2	platinum	Pt
67.6	tungsten	W
68.2	gold	Au
69.7	rhenium	Re
70.2	mercury	Hg
71.8	osmium	Os
72.2	thallium	Tl
73.9	iridium	Ir
74.2	lead	Pb
76.1	platinum	Pt
78.4	gold	Au
80.7	mercury	Hg
83.0	thallium	Tl
85.4	lead	Pb

Appendix J
Chemical composition of NIST samples

Non-certified value standards

Non-certified values are provided for ***information*** only. All non-certified values are listed in parentheses. Standards for many elements do not have certified values. This occurs because:

- some bias is suspected in one or more of the methods used for certification, or
- two independent methods of certification are not available.

As more data becomes available, certified-value standards will likely become available for some of these elements.

Table D-1. High standard certified values

Element	wt. %	Element	µg/g
Aluminum	6.440 ± 0.08	Antimony	38.4 ± 3.0
Calcium	1.250 ± 0.03	Arsenic	626.0 ± 38.0
Iron	3.380 ± 0.10	Barium	707.0 ± 51.0
Magnesium	0.853 ± 0.042	Cadmium	21.8 ± 0.2
Manganese	1.010 ± 0.04	Copper	2,950.0 ±130.0
Phosphorus	0.106 ± 0.015	Lead	5,532.0 ± 80.0
Potassium	2.110 ± 0.11	Mercury	32.6 ± 1.8
Silicon	28.970 ± 0.18	Nickel	14.3 ± 1.0
Sodium	1.140 ± 0.06	Silver	35.3 ± 1.5
Sulfur	0.240 ± 0.006	Vanadium	76.6 ± 2.3
Titanium	0.283 ± 0.010	Zinc	6952.0 ± 91.0

Table D-2. High standard non-certified values

Element	wt. %	Element	µg/g
Carbon	(3)	Bromine	(6)
		Cerium	(57)
		Cesium	(107)
		Chromium	(39)
		Cobalt	(10)
		Dysprosium	(5.4)
		Europium	(1)
		Gallium	(34)
		Gold	(0.6)
		Hafnium	(3.2)
		Holmium	(0.6)
		Indium	(5.1)
		Lanthanum	(34
		Molybdenum	(19)
		Neodymium	(23)
		Rubidium	(2)
		Samarium	(7.8)
		Scandium	(8.7)
		Strontium	(240)
		Thallium	(1.3)
		Thorium	(13)
		Tungsten	(93)
		Uranium	(25)
		Ytterbium	(1.3)
		Yttrium	(23)

Table D-3. Low standard certified values

Element	wt. %	Element	µg/g
Aluminum	7.50 ± 0.06	Antimony	7.9 ± 0.6
Calcium	1.89 ± 0.05	Arsenic	17.7 ± 0.8
Iron	3.50 ± 0.11	Barium	968 ± 40
Magnesium	1.51 ± 0.05	Cadmium	0.38 ± 0.01
Phosphorus	0.062 ± 0.005	Chromium	130 ± 4
Potassium	2.03 ± 0.06	Cobalt	13.4 ± 0.7
Silicon	29.66 ± 0.23	Copper	34.6 ± 0.7
Sodium	1.16 ± 0.03	Lead	18.9 ± 0.5
Sulfur	0.089 ± 0.002	Manganese	538 ± 17
Titanium	0.342 ± 0.024	Mercury	1.40 ± 0.08
		Nickel	88 ± 5
		Selenium	1.57 ± 0.08
		Silver	0.41 ± 0.03
		Strontium	231 ± 2
		Thallium	0.74 ± 0.05
		Vanadium	112 ± 5
		Zinc	106 ± 3

Table D-4. Low standard non-certified values

Element	wt. %	Element	mg/g
Carbon	(1.2)	Cerium	(42)
		Cesium	(5.3)
		Dysprosium	(3.5)
		Europium	(0.9)
		Gallium	(14)
		Gold	(0.3)
		Hafnium	(3.7)
		Holmium	(0.54)
		Iodine	(5)
		Lanthanum	(23)
		Molybdenum	(2.0)
		Neodymium	(19)
		Rubidium	(96)
		Samarium	(3.8)
		Scandium	(12)
		Thorium	(11)
		Tungsten	(2)
		Uranium	(3)
		Ytterbium	(1.6)
		Yttrium	(18)
		Zirconium	(160)

Table D-5. Medium standard certified values

Element	wt. %	Element	µg/g
Aluminum	6.53 ± 0.09	Antimony	19.4 ± 1.8
Calcium	2.88 ± 0.08	Arsenic	105.0 ± 8.0
Iron	2.89 ± 0.06	Barium	726.0 ± 38.0
Magnesium	1.05 ± 0.03	Cadmium	41.7 ± 0.25
Phosphorus	0.086 ± 0.007	Copper	114.0 ± 2.0
Potassium	2.45 ± 0.08	Lead	1162.0 ± 31.0
Silicon	30.44 ± 0.19	Manganese	638.0 ± 28.0
Sodium	1.14 ± 0.03	Mercury	6.25 ± 0.19
Sulfur	0.042 ± 0.001	Nickel	20.6 ± 1.1
Titanium	0.306 ± 0.023	Selenium	1.52 ± 0.14
		Silver	4.63 ± 0.39
		Strontium	245.3 ± 0.7
		Thallium	2.47 ± 0.15
		Vanadium	81.6 ± 2.9
		Zinc	350.4 ± 4.8

Table D-6. Medium standard non-certified values

Element	wt. %	Element	µg/g
Carbon	(2)	Bromine	(5)
		Cerium	(69)
		Cesium	(6.1)
		Chromium	(47)
		Cobalt	(10)
		Dysprosium	(5.6)
		Europium	(1.1)
		Gallium	(15)
		Gold	(.03)
		Hafnium	(7.3)
		Holmium	(1)
		Indium	(1.1)
		Iodine	(3)
		Lanthanum	(40)
		Molybdenum	(1.6)
		Neodymium	(31)
		Rubidium	(110)
		Samarium	(5.9)
		Scandium	(9)
		Thorium	(14)
		Tungsten	(3)
		Uranium	(2.6)
		Ytterbium	(2.7)
		Yttrium	(25)
		Zirconium	(230)

ATTACHMENT C

Performance Characteristic Sheet for

Niton 300 and 700 Series XRF Spectrum Analyzer

Performance Characteristic Sheet

EFFECTIVE DATE: April 17, 1998 **EDITION NO.: 4**

MANUFACTURER AND MODEL :
Make: *Niton Corporation*
Models: *XL-309, 701-A, 702-A, and 703-A Spectrum Analyzers*
Source: ^{109}Cd (10 - 40 mCi initial source strength)
Note: This Performance Characteristic Sheet (PCS) is applicable to the listed Niton XRF instruments which have an operating software version of 5.1 (or equivalent) using a variable-time mode, and to Niton instruments having an operating software version of 1.2C (or equivalent) using a fixed-time mode. This sheet supersedes all previous sheets for the XRF instruments made by the Niton Corporation and the 1993 testing of XL prototypes reported in the document titled: *A Field Test of Lead-Based Paint Testing Technologies: Technical Report* (EPA Report No. 747-R-95-002b, May 1995).

FIELD OPERATION GUIDANCE

This PCS provides supplemental information to be used in conjunction with Chapter 7 (Lead-Based Paint Inspection) of the HUD *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* ("HUD Guidelines"). Performance parameters shown in this sheet are applicable only when operating the instrument using the manufacturer's instructions and the procedures described in Chapter 7 of the HUD Guidelines.

OPERATING PARAMETERS:

Use of variable-time paint test mode ("K & L + Spectra" mode) on instruments running software version 5.1 (or equivalent) using the "Combined Lead Reading" with the instrument's display of a 95%--confident (2-sigma) *Positive* or *Negative* determination versus the action-level as the stopping point of the measurement.

Use of nominal 20-second readings for L-shell results or 120-second readings for K-shell results on instruments running software version 1.2C (or equivalent) in a fixed-time mode.

XRF CALIBRATION CHECK LIMITS:

0.9 to 1.2 mg/cm^2 (inclusive) for instruments running software version 5.1 (or equivalent)
0.9 to 1.1 mg/cm^2 (inclusive) for instruments running software version 1.2C (or equivalent)

SUBSTRATE CORRECTION :
(applicable to instruments running software versions 5.1 (or equivalent) or 1.2C (or equivalent))

For XRF results below 4.0 mg/cm^2, substrate correction recommended for:

None.

Substrate correction is not recommended for:

Brick, Concrete, Drywall, Metal, Plaster, and Wood

THRESHOLDS:
(applicable to instruments running software versions 5.1 (or equivalent) or 1.2C (or equivalent))

DESCRIPTION	SUBSTRATE	THRESHOLD* (mg/cm^2)
Results not corrected for substrate bias	Brick	1.0
	Concrete	1.0
	Drywall	1.0
	Metal	1.0
	Plaster	1.0
	Wood	1.0
*For instruments running software version 1.2C (or equivalent), application of the decision making methodology recommended in this PCS can result in inconclusive results regardless of whether decisions are based on L-shell readings, K-shell readings, or both.		

BACKGROUND INFORMATION

EVALUATION DATA SOURCE AND DATE

Performance parameters shown on this sheet are calculated from the EPA/HUD evaluation using archived building components. Three rounds of tests were conducted on approximately 150 test locations in each round.

One round of testing was conducted March 1995 using a single instrument with an October 1994 source at 10 mCi initial strength while running software version 1.2C in a fixed-time mode with nominal 20-second readings for L-shell results or 120-second readings for K-shell results.

The two other rounds of testing were conducted December 1997 using three different instruments, each running software version 5.1. Two of these instruments had new sources installed November 1997, the other instrument had a new source installed December 1997, all with 10 mCi initial strength. The December 1997 testing was performed in the variable-time paint test mode "K & L + Spectra" using the "Combined Lead Reading" with 2-sigma confidence interval as the stopping point of the measurement.

XRF CALIBRATION CHECK:

The calibration of the XRF instrument should be checked using the paint film nearest 1.0 mg/cm^2 in the NIST Standard Reference Material (SRM) (e.g., for NIST SRM 2579, use the 1.02 mg/cm^2 film). Measurements should be bracketed by successful XRF calibration check readings. XRF calibration checks are performed at the beginning and end of the day's inspections or at extended delays in testing, and (at least) every four hours during inspections or at a frequency recommended by the manufacturer, whichever is more stringent. If readings are outside the acceptable calibration check range, follow the manufacturer's instructions to bring the instrument into control before XRF testing proceeds. Measurements which are not bracketed by successful calibration checks should be considered suspect.

EVALUATING THE QUALITY OF XRF TESTING

Randomly select ten testing combinations for re-testing from each house or from two randomly selected units in multifamily housing. (A testing combination is a location on a painted surface as defined in Chapter 7 of the HUD Guidelines.) For testing combinations involving up to four walls in a room, each wall is classified on its individual XRF reading. (See Chapter 7 for testing procedures if there are more than four walls in a room, and for testing exterior walls.)

For instruments running software version 5.1 (or equivalent), conduct the test in the variable-time paint test mode "K & L + Spectra" using the "Combined Lead Reading" with 2-sigma confidence interval as the

stopping point of the measurement. For instruments running software version 1.2C (or equivalent) in the fixed-time mode, use either 20-second readings for the L-shell results or 120-second readings for the K-shell results, as described in the "Classifications of Results" section below.

Conduct XRF re-testing at the ten testing combinations selected for re-testing.

Determine if the XRF testing in the units or house passed or failed the test by applying the steps below.

Compute the Retest Tolerance Limit by the following steps:

Determine XRF results for the original and retest XRF readings. Do not correct the original or retest results for substrate bias. In single-family and multifamily housing, a result is defined as a single reading. Therefore, there will be ten original and ten retest XRF results for each house or for the two selected units.

Calculate the average of the original XRF result and retest XRF result for each testing combination.

Square the average for each testing combination.

Add the ten squared averages together. Call this quantity C.

Multiply the number C by 0.0072. Call this quantity D.

Add the number 0.032 to D. Call this quantity E.

Take the square root of E. Call this quantity F.

Multiply F by 1.645. The result is the Retest Tolerance Limit.

Compute the average of all ten original XRF results.

Compute the average of all ten retest XRF results.

Find the absolute difference of the two averages.

If the difference is less than the Retest Tolerance Limit, the inspection has passed the retest. If the difference of the overall averages equals or exceeds the Retest Tolerance Limit, this procedure should be repeated with ten new testing combinations. If the difference of the overall averages is equal to or greater than the Retest Tolerance Limit a second time, then the inspection should be considered deficient.

Use of this procedure is estimated to produce a spurious result approximately 1% of the time. That is, results of this procedure will call for further examination when no examination is warranted in approximately 1 out of 100 dwelling units tested.

BIAS AND PRECISION:

Bias and precision data were not computed for instruments using software version 5.1 and taking variable mode readings. (See Appendix B, Section B.3.2 of the document titled *Methodology for XRF Performance Characteristic Sheets*, EPA-747-R-45-008, September 1997). During the 1997 testing, there were 12 testing locations with laboratory-measured lead levels equal to or greater than 4.0 mg/cm^2 lead which were tested using two instruments in the variable-time paint test mode. None of these testing locations had XRF readings less than 1.0 mg/cm^2. These data are for illustrative purposes only. Substrate correction is not recommended for this XRF instrument.

The bias and precision data given below are for instruments running software version 1.2C (or equivalent) and were computed without substrate correction using the 20-second L-shell readings from samples with

reported laboratory results less than 4.0 mg/cm^2 lead. Readings reported by the instrument in the "*x*" or ">>*x*" format were not used in the computation. During the 1995 testing there were 15 test locations with a laboratory reported result equal to or greater than 4.0 mg/cm^2 lead. Of these, 12 readings were reported in the ">*x*" or ">>*x*" format, but of the 3 remaining, 1 had an XRF reading less than 1.0 mg/cm^2.

Bias & Precision Results for Niton Model XL-309 Instruments Using Software Version 1.2C (or equivalent)

MEASURED AT	SUBSTRATE	BIAS (mg/cm^2)	PRECISION* (mg/cm^2)
0.0 mg/cm^2	All	0.0	<0.1
0.5 mg/cm^2	All	0.0	0.2
1.0 mg/cm^2	All	0.0	0.3
2.0 mg/cm^2	All	-0.1	0.5
*Precision at 1 standard deviation			

CLASSIFICATION OF RESULTS:

This section describes how to apply information displayed by this instrument to determine the presence or absence of lead in paint using the procedures recommended in Chapter 7 of the HUD Guidelines. These guidelines recommend classifying XRF results as positive, negative, or inconclusive compared to the lead-based paint 1.0 mg/cm^2 standard.

For Niton Model XL-309, 701-A, 702-A, and 703-A instruments running software version 5.1 (or equivalent), XRF results are classified using a threshold. There is no inconclusive classification when using the threshold for instruments running software version 5.1. In single-family and multifamily housing, an XRF result is a single reading taken on each testing combination. (A testing combination is a location on a painted surface as defined in Chapter 7 of the HUD Guidelines.) For testing combinations involving up to four walls in a room, each wall is classified on its individual XRF reading. (See Chapter 7 for testing procedures if there are more than four walls in a room, and for testing exterior walls.) For computing the XRF result, use all digits that are displayed by the instrument as the "Combined Lead Reading." Results are classified as positive (i.e., ≥ 1.0 mg/cm^2), if greater than or equal to the threshold, or negative (< 1.0 mg/cm^2) if less than the threshold. Threshold values, provided in the tables above, were determined by comparing XRF test results to the 1.0 mg/cm^2 standard.

For Niton Model XL-309 instruments running software version 1.2C (or equivalent), additional procedures are needed to classify readings because this software displays readings and ancillary information useful for classification purposes. An algorithmic procedure is described that makes use of the XRF reading and other displayed information.

The algorithm for classifying results is first applied to 20-second nominal L-shell readings followed by 120-second nominal K-shell readings to resolve inconclusive results, or to recommend laboratory analysis of paint-chip samples, if necessary. A listing of laboratories recognized by the EPA National Lead Laboratory Accreditation Program (NLLAP) for the confirmational analysis of inconclusive results is available from the National Lead Clearinghouse at 1-800-424-LEAD.

XRF results are classified using threshold values for the Model XL-309 software version 1.2C (or equivalent). Results are classified as positive if greater than or equal to the threshold, and as negative if less than the threshold. There is no inconclusive classification when using threshold values. However, in some cases, inconclusive results still may be obtained regardless of whether decisions are based on L-shell readings, K-shell readings, or both, as described below. Use all digits that are reported by the instrument. Threshold values, which were determined for comparing results to the 1.0 mg/cm^2 standard, are provided in the table above.

This instrument displays its lead-based paint measurements as both L-shell and K-shell readings based on

the corresponding L-shell and K-shell X-ray fluorescence (refer to Chapter 7 of the HUD Guidelines for more details). The L-shell readings (or L-readings) are displayed as a numerical result alone, or as a numerical result preceded by either one greater-than symbol (">") or preceded by two greater-than symbols (">>"). The two greater-than symbols will only be displayed when the detected lead level is greater than 5.0 mg/cm^2. Since the maximum lead level reported by this instrument is 5.0 mg/cm^2, lead levels greater than 5.0 mg/cm^2 are displayed as ">>5.0". Other examples of how L-readings can be displayed (in mg/cm^2 units) are "0.6" and ">0.9". The numerical display alone implies that the instrument measured the lead in the paint at the displayed level using L-shell X-ray fluorescence; 0.6 mg/cm^2 in the example. A number preceded by a single greater-than symbol indicates that the measurable lead is deeply buried in the paint and the detected lead level is greater than the displayed value. In the example, >0.9 indicates that the instrument detected lead deeply buried in paint at a level greater than 0.9 mg/cm^2. K-shell readings (or K-readings) are displayed in one of two ways: 1) as a single K-reading plus and minus a "precision" value or 2) as an upper K-reading and lower K-reading.

The same method is used for testing in single-family and multifamily housing. The HUD Guidelines recommend taking a single XRF reading on a testing combination. (A testing combination is a location on a painted surface as defined in Chapter 7 of the HUD Guidelines.) For testing combinations involving up to four walls in a room, each wall is classified on its individual XRF reading. (See Chapter 7 for testing procedures if there are more than four walls in a room, and for testing exterior walls.)

A. Take a single 20-second nominal reading on each testing combination.

B. Classify the L-reading based on the type of information displayed.

   <u>If two greater-than symbols are displayed then</u>:

   - Classify the >>5.0 L-reading as POSITIVE

   <u>If one greater-than symbol is displayed then</u>:

   - Classify the L-reading as POSITIVE if the numerical result that follows the greater than symbol is equal to or greater than 1.0.

   - Classify the L-reading as INCONCLUSIVE if the numerical result that follows the greater than symbol is less than 1.0.

   <u>If the numerical L-reading is displayed alone (that is, without any preceding greater-than symbols) then</u>:

   - Classify the L-reading as POSITIVE if the numerical result is equal to or greater than 1.0.

   - Classify the L-reading as NEGATIVE if the numerical result is less than 1.0.

C. Resolution of results classified as inconclusive.

   All results classified as inconclusive above require further investigation. Take a 120-second nominal XRF reading and use the K-shell reading. In multifamily housing, resolve the inconclusive classification with a single K-shell reading or laboratory analysis as described below.

   - Classify the result as POSITIVE if either the K-reading minus the displayed precision value <u>or</u> the lower K-reading is equal to or greater than 1.0.

   - Classify the result as NEGATIVE if either the K-reading plus the displayed precision value <u>or</u> the upper K-reading is less than 1.0.

   - Classify the result as INCONCLUSIVE if neither of the above decision rules using the K-reading provided a classification which can occur when the upper K-reading is equal to or greater than 1.0 or the lower K-reading is less than 1.0.

- To resolve a remaining INCONCLUSIVE classification, remove a paint-chip sample as described in Chapter 7 of the HUD Guidelines and have it analyzed by a qualified laboratory as described in Chapter 7.

TESTING TIMES (FOR SOFTWARE VERSION 5.1):

For the variable-time paint test mode "K & L + Spectra," the instrument continues measuring until a positive or negative result is indicated relative to an action level (1.0 mg/cm^2 for archive testing) and the current precision, or until the reading is terminated by moving the instrument away from the testing surface. None of the variable mode readings were terminated because of the two-minute limit used for archive testing. The following table provides testing time information for this testing mode. Source strength and type of substrate will affect actual testing times.

Testing Times for Instruments Running Software Version 5.1						
Variable mode testing times (seconds)						
	All data			Median for laboratory—measured lead levels (mg/cm^2)		
Substrate	25th Percentile	Median	75th Percentile	Pb < 0.25	0.25 <= Pb < 1.0	1.0 <= Pb
Wood Drywall	6	8	15	6	20	5
Metal	6	13	20	13	20	6
Brick Concrete Plaster	6	11	20	9	18	6

DOCUMENTATION:
This PCS was developed in accordance with the methodology in the EPA report titled *Methodology for XRF Performance Characteristic Sheets* (EPA 747-R-95-008, September 1997). This report provides an explanation of the statistical methodology used to construct the data in the sheets, and provides empirical results from using the recommended inconclusive ranges or thresholds for specific XRF instruments. For a copy of this document call the National Lead Clearinghouse at 1-800-424-LEAD.

This XRF Performance Characteristic Sheet was developed by the Midwest Research Institute (MRI) under a grant from the U. S. Environmental Protection Agency and a separate contract between MRI and the XRF manufacturer. The U.S. Department of Housing and Urban Development (HUD) has determined that the information provided here is acceptable when used as guidance in conjunction with Chapter 7, Lead-Based Paint Inspection, of HUD's *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*. While MRI reserves the right to revise this XRF Performance Characteristic Sheet at any time, HUD's statement of acceptance would not apply to a revision until HUD has reviewed the revision and made a determination of its acceptability.

TECHNICAL STANDARD OPERATING PROCEDURE

Date: August 28, 2002 SOP No. MFG-VBI70-03

Title: **Dust Wipe Sampling**

APPROVALS:

MFG, Inc.

Author: _____ Date: _____

SYNOPSIS: Provides procedures and instructions for the location and collection of dust wipe samples for laboratory analysis.

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Region 8	Bonnie Lohr / RPM	9/11/02
MFG, Inc.		9/11/02

REV.	DATE	REVISION DESCRIPTION

VASQUEZ BOULEVARD & INTERSTATE 70 SITE
COMMUNITY HEALTH PROGRAM PILOT STUDY

STANDARD OPERATING PROCEDURE FOR DUST WIPE SAMPLING

1.0 PURPOSE AND SCOPE

These procedures apply to dust wipe sampling performed at the Vasquez Boulevard and Interstate 70 (VB/I-70) Superfund Site during the community health program pilot study.

2.0 TRAINING AND QUALIFICATIONS

All personnel performing these procedures must be trained, Colorado-certified risk assessors for lead-based paint hazards, in accordance with Colorado's Air Pollution Prevention and Control Act, Regulation 19 – Requirements for Lead-Based Paint Abatement.

3.0 PROCEDURES

Dust wipe samples will be collected from the interior of individual residences. Dust samples will be collected from window components (sill and trough) and hard-surface floors for lead analysis. Dust samples may also be collected from exterior wood surfaces for arsenic analysis. The same procedures will be used for both types of dust wipe sampling.

3.1 Equipment

The following is a list of equipment needed to collect dust wipe samples.

- Masking tape.
- 50-mL resealable plastic centrifuge tube
- Tape measure or ruler
- Disposable wipes (thin, pre-moistened wipe, approximately 6 inches by 6 inches)
- Non-powdered plastic gloves

Other equipment needed to follow this procedure include:

- Field form for Dust Sampling
- Clipboard
- Indelible ink marker
- Plastic bags for trash
- Camera and film

3.2 Sample Collection Procedures

Dust wipe samples will be collected from window sills and troughs and from hard-surface floors in areas of the home where children are likely to come in contact with dust. A minimum of three dust wipe samples will be collected in each home. As described in the work plan, the risk assessor will select areas for dust sampling.

USEPA protocols for dust wipe sampling (EPA, 1995) will be used to collect dust wipe samples. These procedures are consistent with those provided by HUD in Appendix 13.1 of the HUD Guidelines for Evaluation and Control of Lead-Based Paint Hazards (HUD, 1995).

1. Don clean gloves.
2. Carefully mark the sampling area using masking tape (a minimum of 0.1 ft^2 for windows)
3. Open a disposable wipe. The top wipe may be discarded if dry.
4. First wipe side to side. Hold one edge of the wipe between the thumb and forefinger and press the towelette over the sampling area starting at one corner. Using a slow side-to-side sweeping motion wipe the entire surface of the sampling area. Fold the towelette in half with the collection area facing together.
5. Second wipe. Follow the same procedure as the first pass, but wipe the area in the reverse direction. Fold the towelette in half again.
6. Third wipe. Wipe around the perimeter of the sampling area. Roll the towelette to secure dust within the wipe.
7. Insert the towelette into the sample collection container.
8. Label the sample collection container.
9. Using a tape measure, measure the sampling area.
10. Record all sample locations and area measurements.
11. Photograph the sampling area.
12. Remove tape and dispose of tape and gloves.
13. Pack the samples along with chain-of-custody information and ship to an NLLAP-recognized analytical laboratory. Follow the sample handling and chain-of-custody procedures given in SOP for Sampling Handling and Shipping.

3.3 Documentation

Whenever dust wipe samples are taken, the following information will be recorded on the Dust Sampling form for each sample:

- Room location (i.e. main living area)
- Surface being sampled (e.g., window sill, floor)
- Location within the room or on exterior
- Color/material of surface sampled
- Date and time of sampling
- Sample number
- Notes from the visual inspection.

4.0 QUALITY ASSURANCE SAMPLES

Field blanks, laboratory blanks and spike samples will be collected to assess the quality assurance procedures of the analytical laboratory .

The **field blank** is collected by following the sampling procedure given above except that no area is wiped. The sampler opens a wipe, handles the wipe with gloved hands and folds and refolds the wipe as if sampling. The wipe is contained as a regular sample and shipped to the lab for lead analysis.

The **laboratory blank** is an unused and unhandled wipe that the laboratory analyzes for lead content using identical procedures as for wipe samples.

The **spike** sample is a laboratory-prepared wipe spiked with a known amount of lead. The spike sample is resubmitted to the lab blindly as a routine wipe sample and is analyzed for lead to determine the lead recovery from the wipe material.

At least one field blank, laboratory blank and wipe spike will be analyzed for each brand of wipe used. In addition, one spike sample will be analyzed for every 20 samples submitted to the laboratory. Procedures for spike sample handling are provided in the HUD (1995) guidelines, Appendix 13.1, which is attached to this procedure.

5.0 REFERENCES

Colorado Air Pollution Prevention and Control Act, Regulation 19, Lead-Based Paint Abatement, 1998.

U.S. Department of Housing and Urban Development, 1995. Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, June 1995.

U.S. Environmental Protection Agency, 1995. Residential Sampling for Lead: Protocols for Dust and Soil Sampling. EPA Doc. No. 747-R-95-001, March 1995.

VB/I-70 Pilot Study

Dust Sampling Worksheet

Date: _____ Risk Assessor(s)/Technician(s) _____ _____

Property Address: _____ Property No. _____ Air Pump No. _____

Sample No.	Wipe or Cassette #	Time	Room	Color	Type of Floor Covering	Location and Area

Notes: _____

Beginning Rotometer reading _____ Pump reading _____ End Rotometer reading _____ Pump reading _____

Appendix 13.1: Wipe Sampling for Settled Lead-Contaminated Dust

Wipe samples for settled leaded dust can be collected from floors (both carpeted and uncarpeted), interior and sash/sill contact areas, and other reasonably smooth surfaces. Wherever possible, hard surfaces should be sampled. Wipe media should be sufficiently durable so that it is not easily torn, but can be easily digested in the laboratory. Recovery rates of between 80-120% of the true value should be obtained for all media used for wipe sampling. Blank media should contain no more than 25 µg/wipe (the detection limit using Flame Atomic Absorption). Additional standards for wipe sampling can be found by consulting ASTM ES 30-94.

1. Wipe Sampling Materials and Supplies

a. Type of disposable wipe: Any wipe material that meets the following criteria may be used:

(i) Contains low background lead levels (less than 5 µg/wipe)
(ii) Is a single thickness
(iii) Is durable and does not tear easily (do not use Whatman™ filters)
(iv) Does not contain aloe
(v) Can be digested in the laboratory
(vi) Has been shown to yield 80-120% recovery rates from samples spiked with leaded dust (not lead in solution)
(vii) Must remain moist during the wipe sampling process (wipes containing alcohol may be used as long as they do not dry out)

Examples of acceptable wipe media include: "Little Ones Baby Wash Cloths™," "Little Ones Baby Wipes Natural Formula™," or "Little Ones Baby Wipes Lightly Scented™," available at K-Mart Stores. This product is also available under the brand names "Pure and Gentle Baby Wipes™" and "Fame Baby Wipes™." Individually-packaged "Wash'n Dri Wipes" are also acceptable. "Wet Wipes," which are available at Walgreens and other stores, may also be used. Other brands are also acceptable if equivalence in both lead contamination (analysis of blanks) and laboratory digestion recoveries (analysis of wipes spiked with known amounts of leaded dust, not lead in solution) can be established. The wipes listed above have proven to be sufficiently durable under field use and to have acceptable recovery rates. Do not use "Little Ones Diaper Wipes," also available at K-Mart stores, or any other brand of wipes for which recovery data have not been established. Do not use wipes that contain aloe. Wipes that contain alcohol may be used as long as they do not dry out during the wipe process.

b. Non-sterilized non-powdered disposable gloves. Disposable gloves are required to prevent cross-sample contamination from hands.

c. Non-sterilized polyethylene centrifuge tubes (50 ml size) or equivalent hard-shell container that can be rinsed quantitatively in the laboratory.

d. Dust sample collection forms contained in these Guidelines

e. Camera & Film to document exact locations (Optional)

f. Template Options

i. Masking tape. Masking tape is used on-site to define the area to be wiped. Masking tape is required when wiping window sills and window wells in order to avoid contact with window jambs and channel edges. Masking tape on floors is used to outline the exact area to be wiped.

ii. Hard, smooth, reusable templates made of laminated paper, metal, or plastic. Note: Periodic wipe samples should be taken from the templates to determine if the template is contaminated. Disposable templates are also permitted so long as they are not used for more than a single surface. Templates must be larger than 0.1 ft^2, but smaller than 2 ft^2. Templates for floors are typically 1 ft^2. Templates are usually not used for windows due to the variability in size and shape (use masking tape instead).

g. Container labels or permanent marker.

h. Trash bag or other receptacle (do not use pockets or trash containers at the residence).

i. Rack, bag, or box to carry tubes (optional)

j. Measuring tape

k. Disposable shoe coverings (optional)

2. Single Surface Wipe Sampling Procedure

a. Outline Wipe Area:

Floors: Identify the area to be wiped. Do not walk on or touch the surface to be sampled (the wipe area). Apply adhesive tape to perimeter of the wipe area to form a square or rectangle of about one square foot. No measurement is required at this time. The tape should be positioned in a straight line and corners should be nominally perpendicular. When putting down any template, do not touch the interior wipe area.

Window sills and other rectangular surfaces: Identify the area to be wiped. Do not touch the wipe area. Apply two strips of adhesive tape across the sill to define a

wipe area at least 0.1 square foot in size (approx. 4 inches x 4 inches).

When using tape, do not cross the boundary tape or floor markings, but be sure to wipe the entire sampling area. It is permissible to touch the tape with the wipe, but not the surface beyond the tape.

b. Preliminary inspection of the disposable wipes:

Inspect the wipes to determine if they are moist. If they have dried out, do not use them. When using a container that dispenses wipes through a "pop-up" lid, the first wipe in the dispenser at the beginning of the day should be thrown away. The first wipe may be contaminated by the lid and is likely to have dried to some extent. Rotate the container before starting to ensure liquid inside the container contacts the wipes.

c. Preparation of centrifuge tubes:

Examine the centrifuge tubes and make sure that the tubes match the tubes containing the blind spiked wipe samples. Partially unscrew the cap on the centrifuge tube to be sure that it can be opened. Do not use plastic baggies to transport or temporarily hold wipe samples. The laboratory cannot measure lead left on the interior surface of the baggie.

d. Gloves

Don a disposable glove on one hand; use a new glove for each sample collected. If two hands are necessary to handle the sample, use two new gloves, one for each hand. It is not necessary to wipe the gloved hand before sampling. Use a new glove for each sample collected.

e. Initial placement of wipe:

Place the wipe at one corner of the surface to be wiped with wipe fully opened and flat on the surface.

f. First wipe pass - (side-to-side):

With the fingers together, grasp the wipe between the thumb and the palm. Press down firmly, but not excessively with both the palm and fingers (do not use the heel of the hand). Do not touch the surface with the thumb. If the wipe area is a square, proceed to wipe side-to-side with as many "S"-like motions as are necessary to completely cover the entire wipe area. (See step h for non- square areas.) Exerting excessive pressure on the wipe will cause it to curl. Exerting too little pressure will result in poor collection of dust. Do not use only the fingertips to hold down the wipe, because there will not be complete contact with the surface and some dust may be missed. Attempt to remove all visible dust from the wipe area.

g. Second wipe pass - (top-to-bottom):

Fold the wipe in half with the contaminated side facing inward. (The wipe can be straightened out by laying it on the wipe area, contaminated side up, and folding it over.) Once folded, place in the top corner of the wipe area and press down firmly with the palm and fingers. Repeat wiping the area with "S"-like motions, but on the second pass, move in a top-to-bottom direction. Attempt to remove all visible dust. Do not touch the contaminated side of the wipe with the hand or fingers. Do not shake the wipe in an attempt to straighten it out, since dust may be lost during shaking.

h. Rectangular areas (e.g. window sills):

If the surface is a rectangle (such as a window sill), two side-to-side passes must be made over half of this surface, the second pass with the wipe folded so that the contaminated side faces inward. For a window sill, do not attempt to wipe the irregular edges presented by the contour of the window channel. Avoid touching other portions of the window with the wipe. If there are paint chips or gross debris in the window sill, attempt to include as much of it as possible on the wipe. If all of the material cannot be picked up with one wipe, field personnel may use a second wipe at their discretion and insert it in the same container. Consult with the analytical laboratory to determine if they can perform analysis of two wipes as a single sample. When performing single-surface sampling, do not use more than two single surface wipes for each container. If heavily dust-laden, a smaller area should be wiped. It is not necessary to wipe the entire window well but do not wipe less than 0.10 ft^2 (approx 4" x 4").

i. Packaging the Wipe:

After wiping, fold the wipe with the contaminated side facing inward again, and insert aseptically (without touching anything else) into the centrifuge tube or other hard-shelled container. If gross debris is present, such as paint chips in a window well, make every attempt to include as much of the debris as possible in the wipe.

j. Labelling the Centrifuge tube:

Seal the tube and label with the appropriate identifier. Record the laboratory submittal sample number on the field sampling form (see Chapters 5 and 14).

k. Area Measurement:

After sampling, measure the surface area wiped to the nearest eighth of an inch using a tape measure or a ruler. The size of the area wiped must be at least 0.10 ft^2 in order to obtain an adequate limit of quantitation (25 µg/wipe is the typical detection limit with flame AA; 25 µg/0.10 square feet = 250 $µg/ft^2$, which is half of the HUD clearance criterion for interior window sills). No more than 2 square feet should be

wiped with the same wipe or else the wipe may fall apart. Record specific measurements for each area wiped on the field sampling form.

l. *Form Completion*

Fill out the appropriate field sampling forms (see Form 5.4 or Form 14.2 in these Guidelines) completely. Collect and maintain any field notes regarding type of wipe used, lot number, collection protocol, etc.

m. *Trash Disposal:*

After sampling, remove the masking tape and throw it away in a trash bag. Remove the glove; put all contaminated gloves and sampling debris used for the sampling period into a trash bag. Remove the trash bag when leaving the dwelling. Do not throw away gloves or wipes inside the dwelling unit where they could be accessible to young children, resulting in a suffocation hazard.

Repeat steps a. through m. for additional samples in the same dwelling unit.

3. Composite Wipe Sampling

Whenever composite sampling is contemplated, consult with the analytical laboratory to determine if the laboratory is capable of analyzing composite samples. When conducting composite wipe sampling, the procedure stated above should be used with the following modifications:

When outlining the wipe areas (step a), set up all of the areas to be wiped before sampling. The size of these areas should be roughly equivalent, so that one room is not over-sampled.

After preparing the centrifuge tube, put on the glove(s) and complete the wiping procedures for all subsamples (steps e-i). A separate wipe must be used for each area sampled. After wiping each area, carefully insert the wipe sample into the same centrifuge tube (no more than 4 wipes per tube).

Once all subsamples are in the tube, label the tube. Record a separate measurement for each area that is subsampled on the field collection form (see Form 5.4a or Form 14.2a for a sample form). Finally, complete trash disposal (step m), making sure that no masking tape is left behind.

Risk assessors and inspector technicians do not have to remove their gloves between subsample wipes for the same composite sample as long as their gloved hands do not touch an area outside of the wipe areas. If a glove is contaminated, the glove should be immediately replaced with a clean glove.

In addition to these procedural modifications, the following rules for compositing should be observed:

- Separate composite samples are required from carpeted and hard surfaces (*e.g.*, a single

composite sample should not be collected from both carpeted and bare floors).

- Separate composite samples are required from each different component sampled (*e.g.*, a composite sample should not be collected from both floors and window sills).

- Separate composite samples are required for each dwelling

4. Blank Preparation

After sampling the final dwelling unit of the day, but before decontamination, field blank samples should be obtained. Analysis of the field blank samples determines if the sample media is contaminated. Each field blank should be labeled with a unique identifier similar to the others so that the laboratory does not know which sample is the blank (i.e., the laboratory should be "blind" to the blank sample).

Blank wipes are collected by removing a wipe from the container with a new glove, shaking the wipe open, refolding as it occurs during the actual sampling procedure, and then inserting it into the centrifuge tube without touching any surface or other object. One blank wipe is collected for each dwelling unit sampled or, if more than one dwelling unit is sampled per day, one blank for every 50 field samples, whichever is less. Also, collect one blank for every lot used. Record the lot number.

5. Inspector Decontamination:

After sampling, wash hands thoroughly with plenty of soap and water before getting into car. A bathroom in the dwelling unit may be used for this purpose, with the owner's or resident's permission. If there is no running water in the dwelling unit, use wet wipes to clean the hands. During sampling, inspectors must not eat, drink, smoke, or otherwise cause hand to mouth contact.

6. Spike Sample Submission

Samples spiked with a known amount of leaded dust should be inserted into the sample stream randomly by the person conducting field sampling to determine if there is adequate quality control of the digestion process at the laboratory. Dust-spiked wipe samples should be submitted blindly to the laboratory by the individual performing field sampling at the rate of no less than one for every fifty field samples. Any laboratory can spike wipe samples using the procedure in Appendix 14.3. The laboratory performing the analysis of the field samples can also prepare the spike sample as long as the person performing the field sampling makes the spike sample indistinguishable from the field samples. The person conducting the field sampling should take the spike sample prepared in the laboratory and relabel the container with an identifier similar to the other field samples. The spike sample wipe should not be put into another container. Spike samples should be made using the same lot as that used in the field.

A dust-spiked sample is defined as a wipe or filter containing a known weight of lead-based paint dust, measured to the nearest 0.1 µg of leaded dust. A dust-spiked sample is prepared in a laboratory with the amount of lead-based dust present being between 50 - 1000 µg. For wipe

samples, labs should use NIST Standard Lead Paint Dust (Standard 1578) or an equivalent secondary standard. See Appendix 14.3 for further details.

7. Field Qualifications of Dust Sampling Technicians

All individuals performing dust sampling should have state-certified training. Where possible, field experience in environmental sampling is preferable.

8. Quality Assurance/Quality Control

Blind analysis of spiked samples must fall within 80% - 120% of the true value. If the laboratory fails to obtain readings within the QA/QC error limits:

a. Two more spikes should be sent immediately to the lab for analysis.

b. If the two additional spike samples fail, the sample batch should be considered invalid. A full review of laboratory procedures may be necessary. Additional samples may need to be collected from the dwelling units from locations near the locations previously sampled.

If more than 50 µg/wipe is detected in a blank sample, the samples should be collected again since the media is contaminated. Blank correction of wipe samples is not recommended.

9. Other Information

See Chapter 5 and Chapter 14 for additional information on dust wipe sampling. Also see "Residential Sampling for Lead: Protocols for Leaded Dust and Soil Sampling" from EPA and ASTM ES 30-94 for further information.

TECHNICAL STANDARD OPERATING PROCEDURE

Date: September 6, 2002 SOP No. MFG-VBI70-04

Title: **Vacuum Dust Sampling**

APPROVALS:

MFG, Inc.

Author: _____ Date: _____

SYNOPSIS: Provides procedures and instructions for use of a vacuum to collect dust samples for laboratory analysis.

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Region 8	Bonnie Lamb /RPM	9/11/02
MFG, Inc.		9/11/02

REV.	DATE	REVISION DESCRIPTION

VASQUEZ BOULEVARD & INTERSTATE 70 SITE
COMMUNITY HEALTH PROGRAM PILOT STUDY

STANDARD OPERATING PROCEDURE FOR
VACUUM DUST SAMPLING

1.0 PURPOSE AND SCOPE

These procedures apply to vacuum dust sampling performed at the Vasquez Boulevard and Interstate 70 (VB/I-70) Superfund Site as part of the community health program pilot study.

2.0 TRAINING AND QUALIFICATIONS

All personnel performing these procedures must be trained, Colorado-certified risk assessors or inspectors for lead-based paint hazards, in accordance with Colorado's Air Pollution Prevention and Control Act, Regulation 19 – Requirements for Lead-Based Paint Abatement.

3.0 PROCEDURES

Floor dust samples will be collected from the interior of each residence using a hand-held air-sampling pump and filter cassettes.

3.1 Equipment

The following is a list of equipment needed to collect vacuum dust samples:

- Air-sampling pump – A portable, battery-powered air pump that is capable of the flow rate of 2.5 L/min through an attached filter cassette.
- Collection nozzle – molded tubing that fits tightly on the inlet side of the filter cassette.
- Filter cassette – a pre-weighed 37-mm filter cassette, preloaded with 0.8 μm, pore-size Mixed-Cellulose Ester Filters and backup support pad (laboratory analyzing samples supplies pre-weighed cassettes).
- Calibrated rotameter equipped with inlet and outlet fittings sized for tubing used to connect filter cassette with air-sampling pump.
- Sampling template – A thin (less than 1/8 inch) template that is either disposable or

reusable and inside dimensions measuring 1 foot by 1 foot square.

- Masking tape for holding down sampling templates
- Tubing – Tight fitting flexible tubing for the inlet and outlet of the filter cassette and inlet of air-sampling pump.
- Disposable wipes – for cleaning the template between samples.
- Non-powdered plastic gloves
- Resealable plastic bags for sample filters

Other equipment needed to follow these procedures include:

- Site plan of property (Diagram of Property Interior form) including interior rooms of the main residence (if not recorded during the paint testing).
- Field form: Dust Sampling Worksheet
- Clipboard
- Indelible ink marker
- Plastic bags for trash
- Container for holding and transporting the filter cassettes.

3.2 Sample Collection Procedures

Dust samples will be collected from the floors in areas of the home where children are likely to come in contact with dust. A minimum of three floor-dust samples will be collected in each home. As described in the work plan, the risk assessor will select areas for dust sampling.

The following procedures from USEPA's *Protocols for Dust and Soil Sampling* (EPA, 1995) will be used to collect dust for lead analyses. Samples collected using these methods may be used to determine dust lead loading ($\mu g/ft^2$) and dust lead concentrations (mg/Kg).

1. Sketch a plan of the interior of the house that includes all rooms, sample locations, and other information for that residence and record on Diagram of Property Interior form.
2. Don latex gloves.
3. Place a clean 1 foot by 1 foot square template on the sample surface. Place tape on the outside edges to prevent it from moving during sampling.
4. Remove the sampling cassette's inlet and outlet plugs and place in a resealable plastic bag.
5. Connect collection tubing to the inlet end of the sample cassette and connect additional tubing from the outlet end to the inlet of the air pump.

6. Hold the collection tubing at a 45-degree angle to the surface being sampled and move it back and forth from one side of the template to the other using 3 inch to 4 inch strokes moving the nozzle at a rate of 2 to 4 inches per second. Once the entire surface has been vacuumed in one direction, repeat the procedure vacuuming at 90 degrees from the initial direction. Finally, vacuum the area again in the same direction as the initial coverage.
7. After collecting the sample, remove the cassette from the tubing. Remove and dispose of the collection tubing from the inlet side of the filter. Replace the cassette inlet and outlet plugs.
8. Place the cassette in a container that will hold the cassette securely.
9. Record all sample locations and sample data on the Dust Sampling Worksheet.
10. Pack the samples along with chain-of-custody information and ship to the analytical laboratory. Following the sample handling and chain-of-custody procedures discussed in SOP for Sample Handling and Documentation.

3.3 Documentation

When dust samples are taken, the following information will be recorded on the Dust Sampling Worksheet, for each sample:

- Room location (i.e. main living area)
- Floor surface being sampled (i.e. carpet, area rug, throw rug)
- Location within the room
- Color of the floor covering
- Type of floor covering
- Date and time of sampling
- Cassette number
- Sample number

4.0 QUALITY ASSURANCE/QUALITY CONTROL

Laboratory results will be checked by submitting a pre-weighed but unused dust cassette as a field blank once for every batch of cassettes (i.e., fifty samples). This field blank will be submitted for analysis without removing the cassette's inlet and outlet plugs to insure that it is not exposed to any field conditions. The field blank will be submitted as a regular dust cassette sample with sample identification indistinguishable from regular samples. Laboratory reporting of "insufficient sample" (or similar) will indicate proper quality control procedures during the

following events:

- preparation of the filter cassette prior to shipment,
- during the handling of the cassette in the field,
- during cassette handling and preparation prior to analysis,
- and during transport to and from the laboratory.

5.0 EQUIPMENT CALIBRATION AND MAINTENANCE

The air-sampling pump used for sampling will be fully charged. The air-sampling pump will be calibrated at the beginning and at the conclusion of each day of use for sampling. Calibration results (date, time, flow rate) will be recorded daily on the Air-Pump Calibration Record form. The procedure to calibrate the pump is as follows:

1. Label a filter cassette to distinguish it as one used for calibration (not sampling) and remove the inlet and outlet plugs.
2. Attach a collection nozzle to the inlet side of the filter cassette using a short section of tubing.
3. Insert a calibration rotameter between the air pump and the filter cassette.
4. Turn on the air pump and adjust the flow rate between 2.5-2.8 L/minute.
5. At completion of calibration, dispose of filter cassette and end plugs.
6. Document the calibration in field records (date, time, flow rate).

If the calibration verification performed at the end of the sampling day fails to reproduce the minimum flow rate of 2.5 L/minute, then the samples collected that day are not considered usable and should be discarded. Resampling with calibrated rotameter will be necessary for properties sampled that day.

The rotameter requires periodic calibration servicing in accordance with the instrument manufacturer's instructions. All maintenance instructions from the manufacturer will be followed and documented in instrument maintenance records and project field records.

6.0 REFERENCES

Colorado Air Pollution Prevention and Control Act, Regulation 19, Lead-Based Paint Abatement, 1998.

U.S. Department of Housing and Urban Development (HUD), 1995 rev. 1997. Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, June 1995.

U.S. Environmental Protection Agency, 1995. Residential Sampling for Lead: Protocols for Dust and Soil Sampling. EPA Doc. No. 747-R-95-001, March.

VB/I-70 Pilot Study

Dust Sampling Worksheet

Date: _____ Risk Assessor(s)/Technician(s) _____ _____

Property Address: _____ Property No. _____ Air Pump No. _____

Sample No.	Wipe or Cassette #	Time	Room	Color	Type of Floor Covering	Location and Area

Notes: _____

Beginning Rotometer reading _____ Pump reading _____ End Rotometer reading _____ Pump reading _____

TECHNICAL STANDARD OPERATING PROCEDURE

Date: September 6, 2002 SOP No. MFG-VBI70-05

Title: **Tap Water Sampling**

APPROVALS:

MFG, Inc.

Author: _____ Date: _____

SYNOPSIS: Provides procedures and instructions for the collection of tap water samples for laboratory analysis.

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Region 8	Bonnie Lamb / RPM	9/11/02
MFG, Inc.		9/11/02

REV.	DATE	REVISION DESCRIPTION

VASQUEZ BOULEVARD & INTERSTATE 70 SITE COMMUNITY HEALTH PROGRAM PILOT STUDY

STANDARD OPERATING PROCEDURE FOR TAP WATER SAMPLING

1.0 PURPOSE AND SCOPE

These procedures apply to investigation tap water sampling performed at the Vasquez Boulevard and Interstate 70 (VB/I-70) Superfund Site during the community health program pilot study.

2.0 TRAINING AND QUALIFICATIONS

Personnel performing these procedures must be trained in their use and approved by the project manager. Trained residents and property owners may also collect water samples in accordance with these procedures.

3.0 PROCEDURES

Tap water samples will be collected from the main tap used for drinking water in each home, typically at the kitchen sink. Two samples will be collected: one to represent water held in the faucet and nearby pipes for an extended period of time (i.e., overnight), and one to represent water flushed through the house pipes.

3.1 Equipment

The following types of equipment will be used for tap water sampling:

- Powderless plastic gloves
- Safety glasses
- Two, 1-liter plastic bottles, pre-preserved with nitric acid (bottles supplied by laboratory), one for each sample collected
- Sample labels

- Ink pen or indelible ink marker, blue or black
- "Directions For Residential Tap Water Sample Collection" form (attached)

3.2 Sample Collection Procedures

Prior to sample collection, water must have been stagnant in the pipes (no water use from the tap to be sampled) for a 6- to 8-hour period. Follow the steps below to collect water in bottles that contain nitric acid preservative:

1. Put on the disposable plastic gloves
2. Carefully remove the cap from the Sample 1 bottle
3. Place the Sample 1 bottle under the cold-water tap or faucet and slowly open the tap.
4. Fill the Sample 1 bottle to the base of the neck. Do not rinse the bottle before filling or over fill the bottle because it contains nitric acid.
5. Place the cap back on the Sample 1 bottle and tighten.
6. Flush the cold water tap for approximately 30 seconds.
7. Carefully remove the cap from the Sample 2 bottle
8. Place the Sample 2 bottle under the tap and fill to the base of the neck. Do not rinse the bottle before filling or over fill the bottle because it contains nitric acid.
9. Place the cap back on the Sample 2 bottle and tighten.
10. Complete the "Directions For Residential Tap Water Sample Collection" Form and complete sample labels (if not completed prior to sample collection).
11. Place the sample bottles in a cooler or secure container and maintain at a temperature of 4 ± 2°C.
12. Ship samples to laboratory following chain-of-custody procedures.

When residents agree to collect water samples, the water will be collected into empty containers that do not contain the nitric acid for preservation. In these cases, follow the steps below:

1. Provide resident with instructions for collecting water samples, the attached "Directions for Residential Tap Water Sample Collection."
2. Provide resident with two empty containers marked Sample 1 and Sample 2.
3. Return following day to pick up filled containers.
4. Complete the sample labels and apply to containers while at the property.
5. Place the sample bottles in a cooler or secure container and maintain at a temperature of 4 ± 2°C.

6. At a clean, indoor location with running water available, don gloves and eye protection.
7. Open the first container and add 5 mL of reagent-grade 4N nitric acid and then immediately close container and tighten cap.
8. Open the second container and add 5 mL of reagent-grade 4N nitric acid and then immediately close container and tighten cap.
9. Complete sample labels and apply to each container.
10. Place each container in its own sealable plastic bag and place them in a cooler or secure container and maintain at a temperature of $4 \pm 2^{o}C$.
11. Ship samples to laboratory following chain-of-custody procedures.

3.3 Documentation

The following information will be documented for each tap water sample collected:

- Property number
- Sample ID
- Resident's name
- Property address and telephone number
- Date and time of collection
- Approximate time that tap was last used prior to sampling
- Length of time tap flushed prior to collecting samples if different from the above procedures
- Sampler's signature and date
- Sample custody procedures (sample bottle delivery and pick-up information)

If residents collect the samples then the "Directions For Residential Tap Water Sample Collection" form will be completed, signed, kept with samples until they are shipped to the laboratory. These forms will then be stored in the project files.

CONTENTS OF WATER SAMPLE KIT

1) Sample cooler

2) 2 sample bottles

3) Ice packs to be placed beside or on top of bottles after sample collection

4) Directions for Residential Tap Water Sample Collection

5) Latex gloves to be worn during sampling

Resident's Name
Property Address _____ Telephone_____

DIRECTIONS FOR RESIDENTIAL TAP WATER SAMPLE COLLECTION

These water samples are being collected to determine the contribution of faucet fixtures and household pipes and/or solder to the lead levels in tap water. This sampling is part of the Vasquez Boulevard / Interstate 70 Site. Results from the water sampling will be provided to you.

Generally a total of two samples will be collected at your household. One of the samples is to be collected after the water has been stagnant in the pipes for a six to eight hour period. Therefore, either early mornings or evenings, upon returning from work, are the best times for collecting this sample. The second sample is to be collected after allowing the water to run from the kitchen faucet for 30 seconds.

Sample 1 must be collected after a minimum period of **six to eight hours** during which there is no water use. Sample 1 will be collected from the kitchen tap.

Sample 2 will be collected from the kitchen tap **after** Sample 1. The kitchen tap will be flushed (allowed to run) from the cold water tap for 30 seconds before filling the sample bottle.

The following provides procedures to be followed when filling each bottle:

1. Put on latex gloves.
2. Remove the cap from the bottle marked **Sample 1**.
2. Fill the bottle directly from the faucet or tap by placing the open sample bottle under the tap or faucet and then slowly opening the cold-water tap. Fill the bottle to the base of the neck; do not over fill the bottle.
3. Place the cap back on the bottle and tighten the cap.
4. Place the sample bottle in the cooler along with the ice packs provided with the sampling kit.
5. Remove the cap from the bottle marked **Sample 2** and then run cold water from the tap for 30 seconds before starting to fill the bottle.
6. Fill the bottle directly from the faucet or tap by placing the open sample bottle under the tap or faucet. Fill the bottle to the base of the neck; do not overfill the bottle.
7. Place the cap back on the bottle and tighten the cap.
8. Place the sample bottle in the cooler along with Sample 1 and the ice packs provided.

Personnel will pick up the sampling kit as soon after sampling as practical and typically the next day.

If there is a problem when collecting the sample, **please call MFG (Dave Colvin) at (303) 447-1823** for another sample bottle or bottles).

TO BE COMPLETED BY RESIDENT

Water was last used Time: _____ Date:

Sample was collected Time: _____ Date:

I have read the above directions and have taken the tap water samples in accordance with these directions.

SIGNATURE: _____ Date:

TO BE COMPLETED BY EPA (or representative) PERSONNEL

Sample bottle delivered at Time: _____ Date: _____ Name: _____Sample

bottle picked up at Time: _____ Date: _____ Name:

TECHNICAL STANDARD OPERATING PROCEDURE

Date: August 29, 2002 SOP No. MFG-VBI70-06

Title: **Decontamination**

APPROVALS:

MFG, Inc.

Author: _____ Date: _____

SYNOPSIS: Provides procedures and instructions for decontaminating sampling equipment.

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Region 8	Bonnie Lamb /RPM	9/11/02
MFG, Inc.		9/11/02

REV.	DATE	REVISION DESCRIPTION

VASQUEZ BOULEVARD & INTERSTATE 70 SITE COMMUNITY HEALTH PROGRAM PILOT STUDY AND RESIDENTIAL SAMPLING PROGRAM

STANDARD OPERATING PROCEDURE FOR SOIL SAMPLING EQUIPMENT DECONTAMINATION

1.0 PURPOSE AND SCOPE

These procedures apply to soil sampling performed at the Vasquez Boulevard and Interstate 70 (VB/I-70) Superfund Site during the community health program pilot study and the residential sampling program. Methods for decontaminating soil sampling equipment are provided.

2.0 PROCEDURES

Equipment used to collect soil samples will be decontaminated prior to use and in between the collection of composite samples. The equipment requiring decontamination includes the stainless steel trowels or coring devices used to collect the samples and the stainless steel bowls, cups and spoons that may be used to contain or homogenize samples. Soil samples will be collected according to the procedures described in the Soil Sampling SOP.

2.1 Equipment

The following is a list of equipment needed to decontaminate soil sampling equipment.

- Non-phosphate detergent such as Alconox
- Tap water – several gallons probably necessary
- Deionized water
- Chemical-free towels or paper towels
- Cleaning containers – plastic and/or galvanized steel pans or buckets
- Stiff cleaning brushes
- Aluminum foil, plastic wrap or plastic bags.
- Plastic bags for trash
- Powderless plastic gloves

2.2 Equipment Decontamination Procedures

1. Add the non-phosphate detergent to the appropriate amount of tap water in one of the clean plastic or stainless steel containers. Stir to mix.
2. Put on a pair of powderless plastic gloves.
3. Using the stiff brush, scrub all soil sampling equipment with the detergent/tap water solution. Scrub the equipment until all visible remnants of soil are removed. During the decontamination process, do not lay any equipment being decontaminated on a surface other than a clean piece of plastic or aluminum foil.
4. Rinse each piece of equipment with clean tap water.
5. Rinse each piece of equipment with deionized water.
6. Place the cleaned equipment on clean aluminum foil or plastic wrap and allow to air dry or dry with clean chemical-free paper towels.
7. If not using the equipment immediately, place the clean dry equipment in plastic bags or wrap in aluminum foil for storage.
8. Contain and dispose of all decontamination water by pouring used solutions onto the ground surface at the sampling location.
9. Clean the container which had the detergent/tap water solution and the brush for future use.

2.3 Documentation

Field notes will describe the procedure used and the frequency of sampling equipment decontamination (this SOP may be referenced). Any procedure not in accordance with this SOP should be documented in the field notes.

TECHNICAL STANDARD OPERATING PROCEDURE

Date: July 28, 2002 SOP No. MFG-VBI70-07

Title: **Sample Handling**

APPROVALS:

MFG, Inc.

Author: _____ Date: _____

SYNOPSIS: Provides procedures and instructions for sample identification, handling, chain-of-custody, and shipping for laboratory analysis.

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Region 8	Bonnie Lee /RPM	9/11/02
MFG, Inc.		9/11/02

REV.	DATE	REVISION DESCRIPTION

VASQUEZ BOULEVARD & INTERSTATE 70 SITE COMMUNITY HEALTH PROGRAM PILOT STUDY AND RESIDENTIAL SAMPLING PROGRAM

STANDARD OPERATING PROCEDURE FOR SAMPLE HANDLING

1.0 PURPOSE AND SCOPE

These procedures apply to all sampling tasks performed at the Vasquez Boulevard and Interstate 70 (VB/I-70) Superfund Site during the community health program pilot study and residential sampling program.

2.0 SAMPLE HANDLING PROCEDURES

Under the Community Health Program Pilot Study, dust, soil and water samples will be collected and paint will be tested for lead at residential properties. Some soil samples will also be analyzed for arsenic. Samples will be collected according to the procedures described in the VB/I-70 Pilot Study Work Plan and specific sampling SOPs referenced therein.

Under the residential sampling program soil samples will be collected and analyzed for lead and arsenic. Samples will be collected according to the procedures described in the Sampling and Analysis Plan and specific sampling SOPs referenced therein.

2.1 Sample Identification

Each sample will be assigned a unique sample identification number. Each identification number assigned to an environmental sample will identify the property from which the sample was collected, the sample matrix, the date of sample collection and sample sequence or depth (if applicable). Sample identification numbers will have several components, as explained using the following example:

V138-W-CHP-1

The first character, V, stands for "VB/I-70" and all real-sample identification numbers will begin with the letter V.

The three numbers that follow the V are the property identification number (138). A

unique property identification number is assigned to each participating property prior to sample collection.

The next letter, W, indicates the sample matrix (W = water, S = soil, P = paint and D = dust).

The following letters indicate the sampling protocols that were used. Use CHP for the community health program pilot study samples (i.e., all dust, paint and water samples and some soil samples) and P3S for Phase III soil samples.

Additional information pertaining to the sample sequence may follow the procedure code. For water samples a "-1" or "-2" would indicate the sample sequence as described in the SOP for water sample collection. A description of any additional information included in the sample identification number will be documented in the field records.

QC samples may have a different sample identification number. For example, an equipment rinsate may be called V138-R-P3S-1 to indicate it is the first (-1) rinsate (R) of equipment used for Phase 3 soil sampling at property number 138.

2.1 Sample Containers and Preservation

Proper sample preparation practices will be observed to minimize sample contamination and avoid repeat analyses due to anomalous analytical results. Sample containers will either be commercially-cleaned bottles or other appropriate sample containers provided by the analytical laboratory or, for soil samples, clean unused plastic bags. Bottles for samples types that require preservation (i.e., water samples) will either be pre-preserved by the laboratory or the preservative will be shipped separately for addition to the samples in the field. Sample preservation should be performed immediately upon collection to ensure that laboratory results are not compromised by improper preservation.

2.2 Sample Chain-of-Custody

After samples have been collected, they will be maintained under strict chain-of-custody procedures. The procedures described below will be used to document the transfer of custody of the environmental samples from the field to the designated analytical laboratory. The field sampling personnel will complete a Chain-of-Custody Record and Request for Analysis (CC/RA) form or similar form supplied by a laboratory for each shipping container (i.e., cooler or other container) of samples to be sent each laboratory for analysis. The CC/RA for a shipping container will list only those samples in that shipping container. Information contained on the

triplicate carbonless CC/RA form includes:

- Project identification;
- Date and time of sampling;
- Sample identification;
- Sample matrix type;
- Sample preservation methods (if any);
- Number and types of sample containers;
- Sample hazards (if any);
- Analysis type requested;
- Sample turn-around time;
- Method of shipment;
- Carrier/waybill number (if any);
- Signature of sampling personnel;
- Signature, name and company of person relinquishing and person receiving the samples when custody is being transferred;
- Date and time of sample custody transfer; and
- Condition of samples upon receipt by laboratory.

The sample collector will cross out any blank space on the CC/RA below the last sample number listed (on the part of the form where samples are listed). A sample label will be affixed to each sample container and filled out using indelible ink. Labels will be protected with a layer of clear tape. Each container will be carefully packaged in a shipping container (typically an ice chest) and shipped to the appropriate laboratory, as described below (Section 2.4).

The sampling personnel whose signature appears on the CC/RA is responsible for the custody of the sample from the time of sample collection until the custody of the sample is transferred to a designated laboratory, a courier, or to another employee for the purpose of transporting the sample to the designated laboratory. The sample is considered to be in custody when the sample is: (1) in the direct possession of the sample custodian; (2) in plain view of the sample custodian; or (3) is securely locked in a restricted access area by the sample custodian.

Custody is transferred when both parties to the transfer complete the portion of the CC/RA under "Relinquished by" and "Received by." Signatures, printed names, company names, date and time are required. Upon transfer of custody, the sampling personnel who relinquished the samples will retain the third sheet (pink copy) of the CC/RA. When the samples are shipped by a common carrier, a Bill of Lading supplied by the carrier will be used to document the sample custody, and its identification number will be entered on the CC/RA. Copies, receipts or carbons of Bills of Lading will be retained as part of the permanent documentation in the project file. It is

not necessary for courier personnel to sign the CC/RA. When the samples are received by the laboratory, the CC/RA will be immediately signed along with the date and time of receipt. The top sheet (white copy) of the CC/RA (or a copy of it) will be returned to the Project Manager with the final analytical report.

2.3 Sample Shipping

All samples collected for laboratory analysis will be labeled and placed in an insulated cooler or other appropriate shipping container. If necessary for sample preservation, bags of ice will be placed around the samples to maintain a temperature of approximately 4°C. The ice in the cooler will be double-bagged. The coolers will be filled with packing material such as vermiculite or styrofoam to prevent sample breakage during shipment. The chain-of-custody forms (Section 2.3) will be placed in a sealed plastic bag and taped to the inside top of the cooler. The cooler will be taped shut and chain-of-custody seals will be attached to the outside of the cooler to ensure that the cooler cannot be opened without breaking the seal. Samples will be shipped via express delivery to the appropriate laboratory.

Attachment B
Forms

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
999 18TH STREET - SUITE 300
DENVER, CO 80202-2466
Phone 800-227-8917
http://www.epa.gov/region08

Ref: 8EPR-SR

Dear Concerned Parent:

The Environmental Protection Agency (EPA) would like to offer assistance to you and your family in finding the possible sources of lead or arsenic in and around your home that might be contributing to the higher than normal levels recently measured in your child.

You took the important first step in protecting your child's health by having your child tested. The next step is to find out the best way your child's levels can be reduced. We at EPA think we can help. How? We want to help you find out where your child is coming into contact with lead or arsenic. This important information will allow you to keep your child away from these sources until they can be eliminated. Then you can work with EPA and other agencies on a plan to eliminate the sources and solve the problem permanently.

EPA can take samples of many possible sources in and around your home and test them for lead and arsenic. We'd like to do that at your home. The fact sheet that's attached to this letter explains the types of samples we plan to take and what we'll do with the information. There is no cost to you.

We need your permission to take samples from inside your house. If you rent your home, we need the owner's permission to take samples from the outside of your house and from your yard. If you'd like us to do this investigation, please read and sign the enclosed form called an "access agreement". That will give EPA the permission we need to do the work.

Thanks for your time and we hope you participate. No one government agency can solve this problem alone. We can all work together to provide a safer, healthier environment for your child.

Sincerely,

Bonnie Lavelle
Remedial Project Manager
Vasquez Boulevard/I-70 Site

AGENCIA DE PROTECCIÓN AMBIENTAL DE LOS EE.UU.
REGIÓN 8
999 18TH STREET - SUITE 300
DENVER, CO 80202-2466
Tel: 800-227-8917
http://www.epa.gov/region08

Ref: 8EPR-SR

Estimados Padres Preocupados:

La *U.S. Environmental Protection Agency* (EPA o Agencia de Protección Ambiental de los EE.UU.) desea ofrecerles apoyo a usted y a su familia para identificar las posibles fuentes de plomo o arsénico en y alrededor de su hogar, que puedan contribuir a los niveles elevados que se midieron recientemente en su niño.

Al llevar a su niño a tenor estas pruebas, usted tomó el primer paso importante. El próximo paso es buscar la mejor manera de reducir los niveles en su niño. Nosotros en la EPA podemos ayudar. ¿Cómo? Deseamos ayudarle averiguar dónde su niño ha tenido contacto con plomo o arsénico. Esta información importante le permitirá mantener a su hijo fuera de estas fuentes hasta que se eliminen. Entonces, usted puede trabajar con la EPA y con las otras dependencias, en un plan para eliminar las fuentes y para buscar una solución permanente.

La EPA está dispuesta a tomar muestras de múltiples fuentes posibles en y alrededor de su hogar y analizarlas para plomo y arsénico. Nos gustaría tomar estas muestras en su hogar. La hoja de datos adjunta a esta carta, explica (1) los tipos de muestras que pretendemos tomar, y (2) qué es lo que haremos con la información recabada. Haremos toda la investigación sin costo alguno para usted.

Necesitamos su permiso para tomar muestras del interior de su casa. Si la casa se renta, requerimos el permiso del dueño para tomar muestras tanto del interior de la casa como en el jardín. En el caso de que desee que investiguemos su hogar, por favor lea y firme el formulario de consentimiento adjunto titulado "Acuerdo de Acceso". Esto nos otorgará el permiso necesario para completar la investigación.

Agradecemos su atención y esperamos que participe. El problema no se soluciona por una sola dependencia gubernamental. Todos podemos trabajar juntos para proporcionar un medio ambiente más seguro y más sano para su hijo.

Atentos saludos,

Bonita "Bonnie" Lavelle
Directora de Proyecto
Sitio de Vasquez Boulevard/I-70

What is a Home Investigation?

FACT SHEET
SEPTEMBER 2002

When we do a home investigation we go to your home and look for places where your children could be coming into contact with too much lead or arsenic. There are many places to look for lead or arsenic. In a home investigation we plan to sample:

✓ tap water,

✓ paint,

✓ soil,

✓ dust,

We will also interview you to help us identify how children at your home might be exposed to lead or arsenic. The home investigation is free, and none of these activities cause damage to your property. All of the investigations are performed while you are at home.

To do a home investigation, all we need is your permission. Then, an Environmental Protection Agency (EPA) representative will call you and arrange an appointment to come out to your home and collect samples. The investigation should take just a few hours. Someone from the Denver Department of Environmental Health will join the EPA representative to help with the sampling and to provide expert advice on household lead issues.

Once we have your results, we will report them to you and provide an explanation about what they mean. If lead-based paint is identified inside or outside of your home, then this information will also be provided to the Northeast Denver Housing Center (they can help you take care of lead-based paint). The results will also be provided to the City and County of Denver's Department of Environmental Health so that their staff can provide follow-up case-management services to your family.

For more information, please call EPA Community Involvement Coordinators Jennifer Chergo at (303) 312-6601, or Pat Courtney at (303) 312-6631.

¿En qué consiste una investigación de hogar?

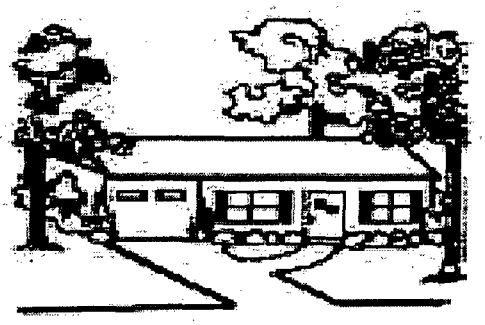
Hoja de datos

SEPTIEMBRE DE 2002

Cuando hacemos una investigación de hogar, visitamos la casa para buscar las áreas donde sus niños puedan tener contacto con demasiado plomo o arsénico. Hay muchos lugares donde hallar plomo o arsénico. Durante una investigación de hogar, tomamos muestras de:

✓ agua de la llave

✓ pintura



✓ suelo

✓ polvo

Además, entrevistaremos a usted para ayudarnos averiguar cómo los niños en su casa pueden estar expuestas a plomo o arsénico. La investigación de hogar es ***gratis,*** y ninguna de estas actividades dañará su propiedad. Se hará toda la investigación mientras usted está presente.

Para hacer una investigación, necesitamos su permiso. Entonces, un representante de la *U.S. Environmental Protection Agency* (EPA, o Agencia de Protección Ambiental) le va a llamar para fijar una cita para llegar a la casa y tomar las muestras descritas anteriormente. La investigación sólo durará un par de horas. Un representante del Departamento de Salud Ambiental de Denver acompañará al representante de la EPA para apoyar las actividades de muestreo y para proporcionar consejo profesional sobre el tema de plomo en el hogar.

Cuando tenemos los resultados de la investigación, usted recibirá un informe sobre ellos junto con una explicación de su significado. En el caso de que se identifique pintura a base de plomo adentro o afuera de la casa, reportaremos esta información al *Northeast Denver Housing Center* (Centro de Vivienda de Noroeste de Denver, una organización sin fines de lucro que puede ayudar con la remoción de pintura a base de plomo). Se informará también al Departamento de Salud Ambiental de Denver para que ellos puedan ofrecer a su familia, los servicios posteriores de manejo de caso.

Para mayor información, por favor llame a los Coordinadores Comunitarios de la EPA: Jennifer Chergo al (303) 312-6601, o a Pat Courtney al (303) 312-6631.

ACCESS AGREEMENT FORM
VASQUEZ BOULEVARD/I-70 SITE
ENVIRONMENTAL INVESTIGATION PILOT STUDY

Resident Name: _____

Property Address: _____

_____

_____

Resident Phone No.: _____

Property Owner Name and Address (if different than resident): _____

_____

Property Owner Phone No.: _____

The U.S. Environmental Protection Agency (EPA) is requesting your voluntary participation in a pilot study to investigate the potential sources of lead and arsenic exposure in and around your home. By participating in the pilot study you agree to permit EPA access to the property to perform soil sampling, paint testing, dust sampling and tap water sampling. An interview will also be conducted to record additional information about your home and your family. None of these activities causes any damage to the property and all are performed while you are at home. The investigation activities are described in more detail in the Pilot Study Work Plan (copies of the work plan are available upon request).

The specific date that your property will be investigated has not been set. We will call you to arrange for an appropriate time to sample your property.

The EPA will report the results of the property investigation to you and also provide an explanation of those results. If requested, the EPA can also provide you with splits of samples so that you can have them tested independently. If lead-based paint is identified in or outside of your home, then this information will also be provided to the Northeast Denver Housing Center. The results may also be provided to the City and County of Denver's Department of Environmental Health so that their staff can provide follow-up case-management services to your family.

Note that by investigating a property, EPA is not confirming that a risk to human health is known to be present or that any response is necessary.

If you are willing to grant access to EPA, and their contractors, and release of the resultant sampling results, please complete all information below, sign on the signature line and include today's date.

Should you have any questions about the pilot study or your participation in the study, please contact Bonnie Lavelle, EPA, at 303-312-6579.

I hereby grant access to the property described above to EPA and/or its contractor(s) for the above-mentioned activities.

Resident Signature _____ Date _____

Owner Signature _____ Date _____

1 copy: Resident
Owner
EPA

ACUERDO DE ACCESO
SITIO VASQUEZ BOULEVARD/I-70
ESTUDIO PRELIMINAR DE INVESTIGACION MEDIOAMBIENTAL

Nombre del Residente: .....

Dirección de la Propiedad:

.....

Número Telefónico del Residente: .....

Nombre del Dueño de la Propiedad: .....

Dirección del Dueño: .....

.....

Número Telefónico del Dueño: .....

La Agencia de Protección Ambiental de los Estados Unidos (EPA, siglas en inglés) solicita su participación voluntario en un estudio preliminar para investigar la exposición a fuentes potenciales del plomo y arsénico adentro y alrededor de su casa.

Por participar en el estudio preliminar, Ud. está de acuerdo a permitir que la EPA tenga acceso a la propiedad para tomar muestras de tierra, polvo y agua de llave y pruebas de pintura. Una entrevista se conducirá para anotar información adicional sobre su casa y su familia. Ningunas de estas actividades dañan ni la casa ni la propiedad y todas se realizan mientras que Ud. esté en casa. Estas actividades de investigación estan descritas con más detalles en el Plan Laboral del Estudio Preliminar (copias del Plan están disponibles al pedirlas).

No se ha determinado la fecha específica en que su propiedad se investigará. Lo llamaremos para hacer una cita conveniente para muestrear su propiedad.

La EPA le reportará los resultados de la investigación de la propiedad y también proveerá una explicación de esos resultados. Si se solicita, la EPA puede proveerle con parte de las mismas muestras para que Ud. pueda realizar su propio análisis independientemente. Si pintura a base de plomo se identifica adentro o alrededor su casa, entonces esta información se proveerá también al Centro de Viviendas de Denver Noreste. Es posible que los resultados también se provea al Departamento de Salud Ambiental de la Ciudad y Condado de Denver para que su personal siga con servicios de manejo de casos para su familia.

Note que al investigar una propiedad, la EPA ni confirma que existe un riesgo a la salud humana ni que sea necesario una acción.

Si Ud. está dispuesto de ceder el acceso a la EPA y su(s) contratista(s) y que se divulgue los resultados del muestreo, por favor complete toda la información abajo, firme y ponga la fecha de hoy.

Si Ud. tiene cualquier pregunta sobre el estudio preliminar, o su participación en el estudio, por favor contáctese a Bonnie Lavelle, EPA, al 303-312-6579.

Por la presente, yo cedo el acceso a la propiedad descrita arriba a la EPA y/o su(s) contratista(s) para los usos descritos previamente.

Firma del Residente **Fecha** _____

Firma del Dueño **Fecha** _____

1 copia: Residente
Centro de Ciencias de Salud de la Universidad de Colorado
EPA

DATA RELEASE FORM
VASQUEZ BOULEVARD/I-70 SITE
ENVIRONMENTAL INVESTIGATION PILOT STUDY

Resident Name: _____

Property Address: _____

_____

_____

Resident Phone No.: _____

The U.S. Environmental Protection Agency (EPA) is requesting your voluntary participation in a pilot study to investigate the potential sources of lead and arsenic exposure in and around your home. This study is being performed to assist you in addressing the sources of lead or arsenic exposure that may be contributing to the blood lead or urine arsenic level of a child, or children, residing at this property. You have been identified as a potential participant in this study because one or more of the young children residing at this property have elevated blood lead or urinary arsenic levels, as indicated by your participation in the University of Colorado's recent health study in your neighborhood.

If you choose to participate in the pilot study, EPA is requesting that you release the results of recent blood lead or urine arsenic tests performed on persons residing at this property. Release of these medical test results is not required for participation in the pilot study. However, it will be helpful for EPA to have these data when reviewing the results from their environmental investigation at your residence, especially in evaluating the potential health risks to young children related to lead or arsenic exposure.

All such data released to EPA will be used to evaluate the human health risks that may be present at individual properties. These data will also contribute to EPA's overall understanding of the causes for elevated blood lead and urine arsenic levels in young children in your neighborhood. The released results will be available for review and use by EPA and its contractor(s), but they will be used in confidence. Names and/or addresses associated with the medical test results will not be used in any records that may be made available to the public through EPA's administrative record for the Superfund Site.

EPA seeks your consent to authorize the University of Colorado's Health Sciences Center to release the blood lead and urine arsenic data for your family. When you consent to the release of these data, EPA will provide this completed form to the University of Colorado's Health Sciences Center project manager who will then provide the released results directly to EPA. Alternatively, you may provide EPA with those results directly by attaching a copy of the result report that you received from the University of Colorado Health Sciences Center.

If you agree to the release of the above-described information to the EPA, and its contractor(s), please complete all information below, sign on the signature line and include today's date.

Should you have any questions about the pilot study, your participation in the study or use of the released information, please contact Bonnie Lavelle, EPA, at 303-312-6579.

I hereby authorize the University of Colorado Health Sciences Center to release all blood lead and urinary arsenic data for persons in my family who reside at the above-reference property to EPA and/or its contractor(s) for the previously described uses.

_____

Signature Date

1 copy: Resident
University of Colorado Health Sciences Center
EPA

PERMISO DE DIVULGACION DE DATOS
SITIO VASQUEZ BOULEVARD/I-70
ESTUDIO PRELIMINAR DE INVESTIGACION MEDIOAMBIENTAL

Nombre del Residente: .....

Dirección de la Propiedad:

.....

Número Telefónico del Residente: .....

La Agencia de Protección Ambiental de los Estados Unidos (EPA, siglas en inglés) solicita su participación voluntaria en un estudio preliminar para investigar la exposición a fuentes potenciales del plomo y arsénico adentro y alrededor de su casa. Este estudio se realiza para ayudarle en quitar e indentificar las fuentes de exposición al plomo o arsénico los cuales posiblemente contribuyan a niveles elevados de plomo en la sangre o de arsénico en la orina de un niño o niños que vivan en esta dirección.

Ud. ha sido identificado como partipante potencial en este estudio porque uno o más de los niños que viven en esta dirección tienen niveles elevados de plomo sanguíneo o de arsénico orinario, indicado por su participación en un recién estudio de salud en su vecindad, hecho por la Universidad de Colorado.

Si Ud. elige participar en el estudio preliminar, la EPA se solicita que Ud. dé el permiso para usar los resultados del análisis de plomo sanguíneo o de arsénico orinal, ya realizado por personas que viven en esta dirección. El permiso para estos resultados de análisis médicos no se requiere para participar en el estudio preliminar. Sin embargo, será útil que la EPA tenga estos datos cuando analizen los resultados de su investigación medioambiental de su casa, especialmente en la evaluación de riesgos potenciales a la salud de los niños en cuanto a la exposición al plomo o arsénico.

Todos tales datos dados a la EPA se usarán para evaluar riesgos de la salud humana que estén en propiedades particulares. Estos datos también se contribuirán al conocimiento de la EPA de las causas de niveles elevados de plomo sanguíneo o de arsénico orinario de un niño o niños en su vecindad. Los datos serán dispuestos para el reviso y uso por la EPA y sus contratista(s), pero se usarán en confianza. Los nombres y/o direcciones asociados con los resultados de pruebas médicas no se usarán en ningún registro que se haga disponible al público a través del registro administrativo de la EPA por el sitio Superfondo.

La EPA pide su consentimiento para autorizar que el Centro de Ciencias de Salud de la Universidad de Colorado divulgue los datos de plomo sanguíneo y de arsénico orinario de su familia. Cuando permite este autorización, la EPA proveerá este formulario al jefe del proyecto en el Centro de Ciencias de Salud de la Universidad de Colorado, quien entonces le dará los resultados directamente a la EPA. Alternativamente, Ud. puede proveer directamente a la EPA los resultados con adjuntar una copia del reporte de resultados que Ud. recibió del Centro de Ciencias de Salud de la Universidad de Colorado.

Si Ud. está de acuerdo con el permiso de la información presentado arriba, dado a la EPA y a sus contratista(s), por favor complete toda la información abajo, firme y ponga la fecha de hoy.

Si Ud. tiene cualquier pregunta sobre el estudio preliminar, su participación en el estudio o el uso de los datos permitidos, por favor contáctese a Bonnie Lavelle, EPA, al 303-312-6579.

Por la presente, yo autorizo que el Centro de Ciencias de Salud de la Universidad de Colorado (University of Colorado Health Sciences Center) divulgue todos los datos de plomo sanguíneo y de arsénico orinario de personas en mi familia, quienes viven a la dirección descrita arriba, a la EPA y/o su(s) contratista(s) para los usos descritos previamente.

Firma _____ **Fecha** _____

1 copia: Residente
Centro de Ciencias de Salud de la Universidad de Colorado
EPA

Environmental Investigation Survey

Property ID No.

Date: _____ DEH EBL Case# _____

Interviewer _____ Other _____

Translator _____

Home Address _____ Zip _____

Mailing Address (if different) _____

Primary Adult Contacts (Parents, Guardians, Grandparents, etc.)

Name(s)	Relationship to EBL Child Mother/Father/other (specify)	Primary Survey Respondent? (Yes/No)

Survey Respondent (if different than above) _____ Relationship _____

Telephone #s (for primary contacts) _____ Home _____ Work

_____ Cellular

If we need to contact you, what language should we use? English Spanish Other _____

Are you the owner of this residence? **Yes** **No**

If no, who is the owner? (name, address, phone#) _____ Relation to Family? (Yes / No)

_____

_____

Year of Construction: _____ Estimated ☐ Confirmed c/ assessor record ☐

If rental, is it OK to contact the landlord if we find problems with the house? **Yes** **No**

Environmental Investigation Survey

Property ID No.

Child EBL Case-Management Information

Note: information requested on next two pages to be collected by City and County of Denver Department of Environmental Health

Name: _____
First Middle Last

Date of Birth: ____/____/____ Gender: F / M

Blood Lead Results

Date	Blood Lead Results	Venous/Cap /Unknown	Source/Clinic (DHMC, etc.)

Why was child tested for lead? Routine Exam Parent request (e.g., pica behavior)

Other (specify) _____

1. Was the child tested for anemia or iron levels? Yes / No
2. If so, what was the result? Anemic / "OK" / Don't know
3. Were you told to give the child iron supplements? Yes / No / Don't Know
4. Where did you get your LEAD blood test done? Were there other previous lead tests? Where? / by Whom?
   (Note if additional tests or different info than above)

Approx Date	Clinic Name	Address	Clinician Name	Phone

5. Does child have insurance? What kind? None Medicaid CHP+ Private _____ Other
6. Do you know anyone else (relative, neighbor, playmate/close friend of child) who has had a high blood lead test?

(name, relationship, address, etc.)

Property ID No.

List children under six years old living in your home:

First Name	Last Name	Gender	DOB (young children only)	Age	Lives in house at least 3 months/year	Had a PbB Test? (List result if known)
		M / F			Y / N	Y / N
		M / F			Y / N	Y / N
		M / F			Y / N	Y / N
		M / F			Y / N	Y / N
		M / F			Y / N	Y / N
		M / F			Y / N	Y / N

How many children 6 years old or older live in your home? **0 1 2 3 4 5 6**
Notes:

List young children that frequently visit the home (neighbors, friends, cousins, etc.):

First Name	Last Name	Gender	Age (approx.)	Describe how often they visit your home: (e.g., how many hours per week)	Do you know if they had a lead test? (result if known)
		M / F			Y / N
		M / F			Y / N
		M / F			Y / N
		M / F			Y / N
		M / F			Y / N

Notes:

Property ID No.

Housing Questionnaire

1. When did you move into your home? _____ **month** _____ **year**

2. Has there been any remodeling or painting at your residence? **Yes** **No** Don't know
If yes, when? _____
what was done? _____

If YES to painting, Did you sand before you painted? **Yes** **No**

3. Are you aware of any pipes or faucets being replaced in the house? **Yes** **No**
If yes, when _____

Where? _____

4. Do you have a wood deck, outdoor furniture or a play area made from pressure-treated wood?
Yes **No** **Don't Know** If yes, how old is it? _____

Have you ever applied wood-sealer to the deck? **Yes** **No** **Don't Know** **If yes, When?** _____

5. Do you have a fireplace/wood stove? **Yes** **No**
If yes, do you burn painted wood in the fireplace/wood stove? **Yes** **No**
do you burn pressure-treated wood in the fireplace/woodstove? **Yes** **No**

6. How do you clean the floor in the: (Vacuum, sweep, mop, list other)

(circle one)

Main living area _____ **How often** _____(per week/month)

Kitchen _____ **How often** _____(per week/month)

Bedrooms_____ **How often** _____(per week/month)

7. Do you have plastic (vinyl) mini blinds? **Yes** **No**
Where? _____
Does the child play with the mini-blinds or touch them? **Yes** **No**

8. Do you have any dogs and/or cats that go in and out of the house? **Yes** **No**
If yes, where do they sleep? _____

9. How many smokers are there in your home? **0** **1** **2** **more**

10. Do any of your children have asthma? **Yes** **No**
If yes, how many? _____

11. Do you have a sandbox? **Yes** **No**

12. Do you have a flower garden? **Yes** **No**

13. Do you have a vegetable garden? **Yes No**

14. Do you use ant killers or other pesticides inside the home? **Yes No**
If yes, describe products and dates of use_____
_____

15. Do you use weed killers or pesticides outside in your yard? **Yes No**
If yes, describe products and dates of use_____

16. What's the source of your drinking water? City water system ☐ purchased ☐ other _____
If use City water from tap, do you use a water filter before drinking/cooking? **Yes No**

17. Is your child on any special diet or does he/she eat any foods that you get from places other than the grocery store?
Yes No
If yes, please explain: _____

18. Do you use any clay pottery or ceramics to cook or store food, especially if handmade or imported from Mexico (e.g., bean pots, tamarindo jam pots, agua frescas, etc.)? **Yes No**

If YES, describe how/when used:

Child Exposure Questionnaire

(Complete one form for each subject child under 6 years old)

Child's Name _____

1. Has your child ever traveled or lived outside of the United States? **Yes** **No**

   If yes, where _____

   when _____

2. Has your child lived at any other address since they were born? **Yes** **No**

   If yes, where? (list below)

Address, City, State	Months at address	Possible Pb or As exposure (remodeling, adults with lead occupations/hobbies, close to an industrial area or highway)	Was the home older than 1960?

3. Does your child spend time at a daycare, preschool, relative's or babysitter's home? **Yes** **No**

   If yes, where (list address): _____

   _____

   How many hours per day, _____ days per week? _____

4. Does your child often visit a building where there is peeling paint? **Yes** **No**

   If yes, estimate the age of the building: **1800's** **Before 1960** **After 1960**

5. Does your child often visit a building where there has been recent or ongoing remodeling? **Yes** **No**

   If yes, estimate the age of the building: **1800's** **Before 1960** **After 1960**

6. Please tell me the number of times your child's hands are washed per day. _____
   Are the child's hands usually washed before they eat? **Yes** **No**
   Before they nap or go to bed? **Yes** **No**

7. Is your child bottle fed? **Yes** **No**

8. Is your child nursing? **Yes** **No**

9. Do you have any concerns with the child's eating habits? **Yes** **No**

Notes:

10. Does your child take vitamins? **Yes** **No**

11. Does your child have any special play areas in the house (e.g., in their bedroom, in open windows)?

_____

Any special play areas outside? _____

12. Does your child use a pacifier? **Yes** **No**

13. Does your child bite his/her fingernails? **Yes** **No**

14. Does your child put their fingers in their mouth? **Yes** **No**

15. Does your child regularly take food, a bottle, or a pacifier outside in warm weather? **Yes** **No**

16. How often does your child put in their mouth non-food items such as toys, sticks, rocks, mini-blinds; etc.?

1 = very little
2 = once or twice a day
3 = more than twice per day
4 = many times per day

17. Does your child eat things that are not food, like dirt and crayons? **Yes** **No**
If YES, What? How much? _____

Can you show me the item? Dirt from Where? _____

18. Have you ever given your child home remedies from another country, such as azarcon or greta, or remedies/medicines not from a drugstore or grocery store? **Yes** **No**

If yes, what remedies?_____
What color was it?_____ Why was it given? _____
How often? Approximately how much? When was the last time it was given?

19. Have you ever seen them eat paint chips or chew on painted wood?**Yes** **No**
Describe: _____

20. Have you ever seen your child play with OR put any of the following things in their mouth: **Yes** **No**

fishing sinkers	curtain weights	keys/keychains	solder/pipes/wires
grass	pool cue chalk	anything made of metal	candy wrappers (especially if Mexican candy)
pottery			

If yes, describe:

21. How often does your child suck his/her thumb, fist or fingers?

1 = very little
2 = once or twice a day
3 = more than twice per day
4 = many times per day

22. How often does your child eat fish, shellfish or other seafood?

Never
___ times per day
___ times per week
___ times per month

23. Where do you think your child may be exposed to lead or arsenic?

24. The following question is asked only for statistical reasons. What is your child's ethnic/racial background? (please check one)

☐ **White,** non Hispanic
☐ **Black,** African American, Negro
☐ **White Hispanic** (includes Spanish, Mexican, Mexican American, Chicano, Latino, Puerto Rican, Cuban)
☐ **Native American**/Alaska native
☐ **Asian** (includes Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, Native Hawaiian, Guamanian or Chamorro, Samoan, Other Pacific Islander, Other Asian)

Family Information

The following question is asked because we wish to use appropriate educational materials. What is the highest grade in school completed by the person who cares for the child (e.g., parent(s), grandparents, etc.)

Person _____ Grade/years _____

_____ _____

Please list the names and occupations of all adults living in this house.

Name	Occupation	Length of employment	Child contact before cleanup/laundering?

Notes:

(Tally up number of children and adults provided as responses to above questions, verify this number.)
"So, the total number of people living in the house is _____".

Please think of all the adults and children who have lived with you in the past two years. Has anyone done the following activities as a hobby or at work?

Activities	Y/N (check if yes)	If yes, Hobby (H) or Work (W)	How often in the past two years?	Where activity done? (e.g., in garage, in backyard, etc.)
Sanded or stripped paint or varnish from furniture		H W		
Painted cars, bicycles, boats		H W		
Repaired radiators in cars		H W		
Soldered pipes, repaired plumbing		H W		
Soldered electronic parts, such as computers or TVs		H W		
Worked with stained glass		H W		
Used artist's paint that might contain lead such as oils		H W		
Made ceramic pottery		H W		
Made or repaired metal jewelry		H W		
Made lead shot for hunting or hand loads		H W		
Did hunting/target shooting or visited a shooting range		H W		
Melted lead sinkers for fishing		H W		
Mined or milled metals		H W		
Painted houses (interior/exterior)		H W		
Welded, cutting, or torch work on metals		H W		
Sanded, stripped, painted industrial equipment such as machinery, bridges, or metal structures		H W		
Worked with lead acid batteries		H W		
Worked with Salvaged or recycled metals		H W		
Did construction work on houses or buildings built before 1980		H W		
Other lead-related hobbies or work activities in the past two years		H W		

If YES to above questions, Was child contact likely? **Yes** **No**

Thank you for answering our questions today.

Now we need to tour the house to draw a diagram for the sampling team. We then need to go outside and take photographs of your home.

Property ID No.

Home Characterization (to be filled out by the interviewer)

1. Is the bathtub old/antique? **Yes** **No** Leadcheck. **Positive** **Negative**
If positive, inquire frequency of child contact. _____

2. Does house have forced-air heating? **Yes** **No**

3. Are there bare soil areas in the yard? **Yes** **No**
   Where? _____
   (e.g., front, back, child play area, etc.)
   How much (approx. percent)? _____

4. Does the house appear to be cleaned regularly? (Circle one)

1 = meticulous
2 = typical
3 = dust appears regularly throughout the house

Attachment C
Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN
FOR SAMPLING, TESTING AND ANALYSIS ACTIVITIES
COMMUNITY HEALTH PROGRAM PILOT STUDY

VASQUEZ BOULEVARD/I-70 SUPERFUND SITE
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LIST OF ACRONYMS

AA	Atomic Absorption
ASTM	American Society for Testing and Materials
CC/RA	Chain-of-Custody Record and Request for Analysis
EPA	United States Environmental Protection Agency
GFAA	Graphite Furnace Atomic Absorption
ICP	Inductively Coupled Plasma-Atomic Emission Spectometry
LCS	Lab Control Samples
LCSD	Lab Control Samples Duplicate
MS	Matrix Spikes
MSD	Matrix Spikes Duplicate
NLLAP	National Lead Laboratory Accredation Program
NTU	Nephelometric Turbidity Unit
QA	Quality Assurance
QAM	Quality Assurance Manager
QAOs	Quality Assurance Officers
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPP	Relative Percent Difference
SOP	Standard Operating Procedures
VB/I-70	Vasquez Boulevard/Interstate 70
XRF	X-Ray Fluorescence

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been developed for sampling, testing and analysis activities to support the Community Health Program Pilot Study for evaluating sources of lead and arsenic exposure within the Vasquez Boulevard/I-70 (VB/I-70) Superfund Site. This QAPP is intended to supplement the Community Health Program Pilot Study Work Plan (the Work Plan) (MFG, 2002) and identifies the procedures and protocols to be followed during sample collection and analysis. Sampling will include the collection and analysis of soil, interior and exterior paint, dust and water samples.

1.1 Project Description

As described in the Pilot Study Plan, samples will be collected and analyzed to evaluate the potential sources of lead and arsenic exposure for young children within the VB/I-70 site and support remedial design. The purpose of each type of sample to be collected and the subsequent data uses are described below.

- Soil – Soil sampling will be conducted to identify potential sources of lead in yard soil. The data will be compared to a range of risk-based criteria for soil (200 to 540 milligrams per kilogram (mg/Kg) lead and 20 to 240 mg/Kg arsenic). The soil data will be used to evaluate levels of lead and arsenic that children may potentially be exposed to when using areas of the yard.
- Interior and Exterior Paint – Interior and exterior paint will be tested to determine if paint is a source of lead to the environment. The lead data will be compared to a value of 1 milligram per square centimeter (mg/cm^2) to identify lead-based paint.
- Dust – Interior dust samples will be collected to determine whether the dust is a lead source. Both vacuum-collected and wipe-collected dust samples will be analyzed for lead. The results will be compared to soil concentration data at the risk-based concentration levels and to criteria for identifying paint hazards (40 $\mu g/ft^2$ on floors, 250 $\mu g/ft^2$ on window sills, as weighted averages for the home).
- Water – Tap water samples will be collected to determine whether drinking water may be acting as a lead source. The lead data will be compared to the drinking water standard of 15 micrograms per liter ($\mu g/L$).

1.2 Project Responsibilities

Key positions related to quality assurance include: the Study Director, Quality Assurance Manager (QAM), the Study Administrator and the Chemist.

The Study Director will oversee all aspects of the program implementation. The Study Director will ensure that the Study Administrator is coordinating all project activities in accordance with the Work Plan, including implementation of this QAPP.

The QAM will be responsible for ensuring that the analytical procedures are performed in accordance with the QAPP and will consult with the Study Administrator to confirm that the field procedures are performed in accordance with the QAPP. The QAM's duties may include reviewing documentation of field sampling procedures, verifying that the laboratory is adhering to project specifications and working with the laboratory if corrective measures are necessary. The QAM may assist the Chemist in performing data evaluation or validation, if necessary. The QAM will discuss any systematic errors or other anomalous data with the Study Director and Study Administrator. If corrective actions are necessary, the QAM will be responsible for confirming that they have been initiated.

The Study Administrator will coordinate various aspects of the pilot study, including the environmental testing component. The Study Administrator will also be the primary contact for participants in the program.

The Chemist will be responsible for coordinating with the laboratory regarding analytical requirements and scheduling. Upon receipt of the analytical data, the Chemist will perform the necessary data validation (the QAM may assist the Chemist in this function, if necessary). The Chemist will also provide support to the field team, QAM and Study Administrator regarding issues concerning sample collection, handling and storage.

The individual laboratory Quality Assurance Officers (QAOs) will also have key positions related to quality assurance and are responsible for all aspects of the sample analyses. The Laboratory QAOs will be responsible for ensuring that sample holding times and custody requirements are met, overseeing the analyses, confirming that the laboratory QA requirements are met, and reviewing the data packages

prior to distribution. The Laboratory QAOs will coordinate with the Chemist regarding any issues related to the sample analyses.

2.0 QUALITY ASSURANCE OBJECTIVES

The project quality assurance (QA) objectives are directly tied to the data needs and data uses described in the Work Plan and summarized in Section 1.0. The QA objectives for each type of data, including acceptable levels of precision, accuracy, representativeness and comparability, are described below. Sampling and analysis procedures necessary to meet the QA objectives are described in Sections 3 and 4, respectively. The types of field and laboratory Quality Control (QC) samples to be collected and analyzed are detailed in Section 5. Definitions of precision, accuracy, respresentativeness and comparability are provided in Section 6. Data that meet their stated QA objectives will be of appropriate quality for supporting remedial design activities at the VB/I-70 site.

2.1 Soil Samples

2.1.1 Soil Samples

Soil samples will be collected at each property according to a site-specific sampling plan developed for that property. The sampling plans will be developed using the guidelines provided in Section 2 of the Work Plan and sampling will be performed in accordance with Standard Operating Procedures (SOPs) included in Attachment A of the Work Plan. Each sampling plan will provide a sufficient number of samples from which to describe the soil conditions in bare areas, play areas, gardens and yard areas. Samples will be collected using consistent methods (SOP for Soil Sampling) to provide comparable results.

As described in Section 4 of this QAPP, soil samples will be composited in the field and then dried and sieved at the laboratory for homogenization prior to analysis. A contract laboratory will analyze the samples for lead and/or arsenic using inductively coupled plasma-atomic emission spectrometry (ICP) methods.

Table 2-1 provides the precision, accuracy, quantitation limit, and completeness objectives for lead analyses of soil samples by ICP. The precision and accuracy of the data will be evaluated relative to the measurement objectives given in Table 2-1. Because some soil samples are expected to be heterogeneous, sample heterogeneity will be considered when evaluating comparability of results from

field duplicate samples. The representativeness of laboratory analyses will be evaluated from analyses of blanks, including equipment rinsates and method blanks.

2.2 Interior and Exterior Paint Samples

Deteriorated interior and exterior paint will be tested in the interior and on the exterior of residences. Testing will be performed using the guidelines provided in Section 4 of the Work Plan and in accordance with the SOPs provided in Attachment A of the Work Plan. Consistent methods (SOP for Paint Testing and Assessment) will be used to provide comparable results.

Paint will be analyzed for lead on site using a portable X-Ray Fluorescence (XRF) instrument. All analyses will be performed by an individual who has been properly trained to use the XRF instrument. Table 2-1 provides the precision, accuracy, quantitation limit, and completeness objectives for lead analyses of paint by XRF.

2.3 Dust Samples

Dust samples will be collected from within each residence by both dust wipe and vacuum collection methods, as described in Section 4 of the Work Plan, and in accordance with the SOPs provided in Attachment A of the Work Plan. Consistent methods (SOP for Dust Wipe Sampling and SOP for Vacuum Dust Sampling) will be used to provide comparable results.

Dust samples will be analyzed for lead by an National Lead-Laboratory Accredation Program (NLLAP) approved laboratory. The laboratory will analyze both vacuum-collected and wipe dust samples using atomic absorption (AA) methods (EPA Method 7420 or Method 7421). If any dust wipe samples are submitted for arsenic analysis, the analyses will be performed by the laboratory using AA methods (EPA Method 7060 or 7061A).

Table 2-1 provides the precision, accuracy, quantitation limit, and completeness objectives for lead analyses of dust filter and wipe samples. The representativeness of laboratory analyses will be evaluated from analyses of filter blanks, wipe blanks and method blanks.

2.4 Water Samples

Tap water will be sampled and analyzed to compare the lead concentration to the drinking water standard for lead of 15 µg/L. Consistent methods (SOP for Tap Water Sampling) will be used to collect water samples and provide for comparable results. Tap water samples collected by residents, as described in the pilot study work plan, will be preserved with nitric acid to a pH less than or equal to 2 within 24 hours of collection. This approach is preferred over having residents collect samples into acid-preserved containers that represent a safety hazard within the home.

Prior to analysis, the turbidity of the water samples will be measured by the laboratory (EPA Method 180.1). If the turbidity is less than one nephelometric turbidity unit (NTU) than no digestion is necessary. If the sample turbidity is greater than one NTU, a total recoverable digestion (EPA Method 200.2) will be performed prior to analysis. Water samples will then be analyzed for lead by graphite furnace atomic absorption (GFAA) analysis (EPA Method 200.9). Lead concentrations in individual samples will be compared to the trigger criterion of 15 µg/L. The precision, accuracy, quantitation limit and completeness objectives for lead analyses of water are provided on Table 2-1. The representativeness of laboratory analyses will be evaluated from analyses of method blanks.

3.0 SAMPLING PROCEDURES

3.1 Sampling Media and Collection Techniques

Environmental samples collected or analyzed to support the pilot study include:

- Soil samples;
- Interior/exterior paint;
- Dust samples (filter and wipe);
- Water samples.

Sample collection procedures are described in the SOPs provided for each matrix in Attachment A of the Work Plan. Procedures for documenting sampling activities and labeling and handling samples are also provided in the SOP for Sample Handling and Documentation (Work Plan, Attachment A).

3.2 Decontamination Procedures

Field equipment and supplies that will be used at more than one sampling location will be decontaminated prior to use and between sampling locations to minimize the potential for cross-contamination of samples. The general decontamination procedures will consist of:

- Scrubbing the sampling equipment with a stiff brush in a solution of tap water and non-phosphate detergent until all visible remnants of the sampled media are removed from the equipment during this step;
- Rinsing the sampling equipment with tap water, followed by a second rinse with deionized water; and
- Disposing of the decontamination fluids.

Specific decontamination procedures are specified in the SOPs (Attachment A).

3.3 Sample Custody

After samples have been collected, they will be maintained under strict chain-of-custody procedures. Chain-of-custody procedures are discussed in the SOP for Sample Handling and Documentation (Attachment A of the Work Plan) and are summarized below. The procedures described below are used to document the transfer of custody of the environmental samples from the field to the designated analytical laboratory and the associated documentation requirements. The field sampling personnel will complete a Chain-of-Custody Record and Request for Analysis (CC/RA) form or similar form supplied by a laboratory (refer to SOP for Sample Handling and Documentation) for each shipping container (i.e., cooler or other container) of samples to be sent to each laboratory for analysis. The CC/RA for a shipping container will list only those samples in that shipping container. Information contained on the triplicate carbonless CC/RA form includes:

- Project identification;
- Date and time of sampling;
- Sample identification;
- Sample matrix type;
- Sample preservation method (if any);
- Number and types of sample containers;
- Sample hazards (if any);
- Analysis type requested;
- Sample turn-around time;
- Method of shipment;
- Carrier/waybill number (if any);
- Signature of sampling personnel;
- Signature, name and company of person relinquishing and person receiving the samples when custody is being transferred;
- Date and time of sample custody transfer; and
- Condition of samples upon receipt by laboratory.

The sample collector will cross out any blank space on the CC/RA below the last sample number listed (on the part of the form where samples are listed). A sample label will be affixed to each sample container. The label will be protected with a layer of clear tape. Each container will be carefully

packaged in a shipping container (typically an ice chest) with Styrofoam peanuts, vermiculite or other packing material, if necessary, to prevent breakage during shipment. Custody seals will be signed and dated by the sample custodian prior to shipment. If the custody seal is broken, the laboratory will immediately notify the Project Chemist or Program Director.

The sampling personnel whose signature appears on the CC/RA is responsible for the custody of the sample from the time of sample collection until the custody of the sample is transferred to a designated laboratory, a courier or to another employee for the purpose of transporting the sample to the designated laboratory. The sample is considered to be in custody when the sample is: (1) in the direct possession of the sample custodian; (2) in plain view of the sample custodian; and (3) securely locked in a restricted access area by the sample custodian.

Custody is transferred when both parties to the transfer complete the portion of the CC/RA under "Relinquished by" and "Received by". Signatures, printed names, company names, date and time are required. Upon transfer of custody, the sampling personnel who relinquished the samples will retain the third sheet (pink copy) of the CC/RA. When the samples are shipped by a common carrier, a Bill of Lading supplied by the carrier will be used to document the sample custody, and its identification number will be entered on the CC/RA. Copies, receipts or carbons of Bills of Lading will be retained as part of the permanent documentation in the project file. It is not necessary for courier personnel to sign the CC/RA. When the samples are received by the laboratory, the CC/RA will be immediately signed along with the date and time of receipt. The top sheet (white copy) of the CC/RA (or a copy of it) will be returned to the Program Director with the final analytical report.

4.0 ANALYTICAL PROCEDURES AND CALIBRATION

4.1 Analytical Parameters and Methods

Soil samples will be collected for analysis of lead and/or arsenic. Dust (filters and wipes) and water samples will be collected for analysis of lead, and in some cases arsenic. Paint will be tested in situ for lead content. Table 4-1 provides the analytical methods, preservation and storage requirements, holding times, and quantitation limits required for the analysis of these samples. Water samples collected by residents will be preserved within 24 hours of sample collection. The specified methods provide data of appropriate quality for comparison to the applicable trigger criteria.

Soil samples will be prepared for ICP analysis (EPA Method 6010 B) in accordance with the Sample Preparation SOP included as Attachment A. The samples will be dried and sieved by the laboratory and then subject to a complete digestion procedure (EPA Method 3052) prior to ICP analysis.

Interior/exterior paint samples will be analyzed in the field using a portable XRF instrument. Sample preparation is not required because the paint is analyzed in situ. The XRF instrument will be operated in accordance with the manufacturer's instructions and using matrix-specific calibration models to measure the lead content of paint, as described in the SOP for Paint Testing and Assessment (Attachment A of the Work Plan).

Vacuum dust samples will be obtained in filter cartridges using a vacuum collection method and then analyzed by an NLLAP-approved laboratory (Reservoirs Environmental Services, Inc.). Prior to use for collecting dust samples, the laboratory will weigh and record the weight of the filters. After the samples are collected, the filters will be re-weighed, digested (EPA Method 3050B) and analyzed by AA (EPA Method 7420 or Method 7421). Results for dust samples collected using the vacuum collection method will be reported as mg/Kg and may also be used to compute dust lead loading in $\mu g/ft^2$.

Dust wipe samples will be completely digested (EPA Method 3050B) and analyzed for lead by EPA Method 7420 or 7421 or for arsenic analysis by EPA Method 7060 or 7061A. Results for dust wipe samples will be reported by the laboratory in μg and converted to $\mu g/ft^2$ by the sampler upon receipt of analysis results.

Water samples will be analyzed using AA methods (EPA Method 200.9). The turbidity of the tap water samples will be measured by the laboratory prior to analysis, and if the turbidity is less than one NTU, then no digestion is necessary. If digestion is necessary, a total recoverable digestion will be performed.

4.2 Field Calibration Procedures

It is anticipated that the only calibrated field instruments that will be used for the environmental sampling will be the field XRF instrument used for interior/exterior paint analysis and the air-sampling pump used for the collection of dust samples. The field XRF and air-sampling pump will be calibrated prior to use and at prescribed intervals while in use, if necessary. Frequency of calibration is specified in the SOPs for Paint Testing and Assessment and Vacuum Dust Sampling. Procedures for calibration of instruments will be the standard operating procedures as outlined in the owner's manuals for the specific field instruments.

The portable XRF instrument will be calibrated using empirical methods. Prior to use of the instrument at the site, calibration models will be developed for a wide range of lead concentrations (0 to 20 mg/cm^2) on a variety of substrate surfaces. Calibration check samples, having a known lead concentration in the mid-range of the model's concentration range, will also be measured twice daily. Calibration requirements are described in the SOP for Paint Testing and Assessment (Attachment A of the Work Plan).

The air-sampling pump will be calibrated by inserting a calibration rotameter between the air pump and a filter cassette and adjusting the flow rate accordingly. If the calibration verification performed at the end of the sampling day fails to reproduce the minimum flow rate of 2.5 liters/minute, than the samples collected that day are not considered usable and will be discarded. The air-sampling pump calibration requirements are described in the SOP for Vacuum Dust Sampling (Attachment A of the Work Plan).

4.3 Preventive Maintenance

At a minimum, field equipment will be inspected, visually and functionally, prior to each day's use. Preventive maintenance activities will be documented in records maintained by the instrument operator and filed with the project's other field records. These records will identify the equipment and specify the maintenance tasks completed. The field XRF instrument and air-sampling pump will be cleaned according to the manufacturer's instructions. The XRF instrument will undergo maintenance by the manufacturer annually, including source replacement, as needed. The rotameter used to calibrate the air-sampling pump requires periodic servicing. All field equipment will be kept clean and free of particulate matter to the extent possible.

5.0 INTERNAL QUALITY CONTROL CHECKS

Internal QC will be achieved by collecting and/or analyzing a series of field and laboratory QC samples to assist in confirming that the analytical results meet the measurement objectives detailed in Section 2. Results from analyses of QC samples are used to quantify precision and accuracy and identify any problems or limitation of those data.

5.1 Field Quality Control Samples

Field QC will be controlled by compliance with standard sample collection and handling methods and by the periodic collection of field QC samples. QC samples will not be identified to the laboratory. The appropriate types and frequency of field QC samples depend on the sample type, sample matrix and intended data use. The measurement objectives for the QC samples are included in Table 2-1. A summary of the field QC samples to be collected is provided in Table 5-1.

Five types of quality control samples will be collected during environmental sampling: equipment rinsates, field duplicates, filter blanks, wipe blanks and field blanks.

Equipment rinsates consist of analyte-free reagent water (i.e., American Society for Testing and Materials [ASTM] Type II) poured through the sampling device or equipment, collected in a clean sampling bottle, preserved as needed, and analyzed with the samples. Equipment rinsates may be used to demonstrate that sampling devices have been adequately cleaned between uses and provide representative samples.

A **field duplicate** sample is a second sample collected at the same location as the original sample. Duplicate samples are collected simultaneously with or in immediate succession to the original sample using identical recovery techniques and are treated in identical manner during storage, transportation and analysis. Field duplicate sample results may be used as a measure of method variability, including both sampling and analytical precision.

A **filter or wipe blank** sample consists of an unused air filter or wipe. The filter blank is prepared from an unused filter that has been pre-weighed by the laboratory. The filter is submitted for analysis in an identical manner as the filters used for sampling. The wipe blank is an unopened wipe that is submitted for analysis with the wipes used for sampling. Filter/wipe blank results describe the background lead concentration of the filters/wipes used to collect the dust samples and may be used to assess bias introduced by the filters/wipes.

A **field blank** sample consists of an unused dust wipe. An unused wipe is opened, handled with gloved hands and submitted for analysis in an identical manner as the wipe samples except that no surface is wiped. Field blank results describe the background lead concentration of wipes under ambient field conditions and may be used to assess bias introduced by the wipes.

A **dust-wipe spike sample** is a wipe containing a known weight of lead-based paint dust. The dust spike is prepared by the laboratory and then submitted blindly to the laboratory with other dust samples to determine if there is adequate quality control of the digestion process for recovery of lead.

5.1.1 Soil Samples

Equipment rinsates and field duplicates will be collected with soil samples. Equipment rinsates associated with soil samples will be collected by pouring reagent water through the decontaminated re-usable equipment used to obtain soil samples (e.g., soil scoops and mixing bowls). Field duplicate samples will be collected at the same location as the soil samples, and will be splits of the homogenized samples. The duplicate sample will be assigned a separate sample identification number and will be a blind duplicate to the laboratory. One equipment rinsate and one field duplicate will be collected each day of sampling and submitted for laboratory analysis for lead and/or arsenic.

5.1.2 Interior/Exterior Paint Samples

One sample per residence will be selected for triplicate analysis as a measure of analytical precision. Whenever possible, the triplicate reading will be performed using a sample with a lead concentration greater than 1 mg/cm^2. This one sample will be analyzed three times for lead without moving the probe. The standard deviation of the three measurements must be within $\pm$ 0.1 mg/cm^2. For results greater than 7 mg/cm^2, the relative standard deviation for the three measurements must be within 25 percent. If these objectives are not met, the paint surface will be examined for anomalies and the procedure will be repeated. If the precision objectives are not obtained, the instrument will be recalibrated and the procedure will be repeated.

Precision and accuracy will also be routinely evaluated using reference standard samples. Standard reference checks will be performed at the beginning of each day and approximately every 4 hours thereafter. At the beginning of the day all methods will undergo a standard reference check, but only those methods used on that day will be subjected to routine (every 4 hours) rechecks. Standard

reference checks will be measured in the normal analysis mode and will use the standards closest to 1 mg/cm^2 and 6 mg/cm^2. These standards will be measured five times for 30 seconds each. The average assay value will be compared to the check sample values obtained during method calibration. For 1 mg/cm^2 measurements, the method will be recalibrated if the difference between the average assay and the check sample assay is >0.1 mg/cm^2 and greater than three times the relative standard deviation. For 6 mg/cm^2 measurements, the method will be re-calibrated if the difference between the average assay and the check sample assay is >0.3 mg/cm^2 and greater than three times the relative standard deviation.

5.1.3 Dust Samples

Filter blanks and field duplicates will be collected with the vacuum dust samples. Filter blanks will be collected by containing an unused, pre-weighed filter and submitting to the laboratory for lead analysis.

Field blanks, laboratory blanks and spike samples will be collected with the dust wipe samples. Wipe blanks will be collected by submitting an un-opened wipe to the laboratory for lead analysis. Field blanks will be collected by opening a wipe, handling it with gloved hands and submitting it for analysis in an identical manner as other wipe samples.

A minimum of one filter blank, field wipe blank, laboratory wipe blank and spike will be analyzed with each brand of filter or wipe used for dust collection. In addition, filter blanks and vacuum dust field duplicates will be collected at a frequency of one per 20 dust (filter) samples. Wipe spike samples will be collected at a frequency of one per 20 dust wipe samples.

5.1.4 Water Samples

Field duplicates will be collected with the tap water samples. Field duplicate samples will be collected at the same location and immediately following the collection of water samples. The duplicate sample will be assigned a separate sample identification number and will be a blind duplicate to the laboratory. One field duplicate will be collected for every 20 water samples and analyzed for lead.

5.2 Laboratory Quality Control Samples

Laboratory quality control is necessary to control the analytical process, assess the precision and accuracy of analytical results and identify assignable causes for atypical analytical results. Each laboratory's standard operating procedures and QC practices vary depending on the analysis performed, as described below. The measurement objectives for the QC samples are included in Table 2-1.

5.2.1 ICP Soil Analyses

For soil analyses by ICP, initial and continuing calibration verifications will be performed. Calibration results must meet the laboratory's acceptance criteria. Accuracy will be confirmed through analysis of performance evaluation samples. The performance evaluation samples will be submitted blind to the laboratory and handled using the same preparation and analysis procedures as used for soil samples from the site. In addition, the laboratory will analyze and report the results from method blanks, laboratory control samples (LCS), analytical duplicates and post-digestion matrix spike (MS) samples.

5.2.2 Dust Analyses

For AA analyses (EPA Method 7420 or 7421) of dust samples, initial and continuing calibration verifications will be performed. The precision and accuracy of dust analyses will be controlled through the analysis of method blanks, calibration standard, LCS, MS and duplicates. The scale used to weigh filters will be calibrated, and calibration checks will be performed at least daily.

5.2.3 Water Analyses

For AA analysis (EPA 200.9), initial and continuing calibration verifications will be performed. The laboratory will also report calibration blank, MS and duplicate results in order to assess precision and accuracy.

6.0 CALCULATION OF DATA QUALITY INDICATORS

The parameters that will be used to assess data quality include accuracy, precision, completeness, and representativeness. Definitions of these parameters are provided below. Since the data will be used to evaluate whether response actions are necessary, the accuracy and representativeness of the data will be considered the data quality parameters of most importance. The field and laboratory QC samples and methods which will be employed to assess the data quality are discussed in Section 5.

6.1 Precision

Precision (analytical error) is the level of agreement among repeated measurements of the same characteristic. Data precision will be assessed by determining the agreement among replicate measurements of the same sample and measurements of duplicate samples. As discussed in Section 5, these samples may include MS/MSD samples, LCS/LCSD samples, and analytical and field duplicates. The comparison is made by calculating the relative percent difference (RPD) given by:

$$RPD(\%) = \frac{|S_1 - S_2|}{(S_1 + S_2)/2} \times 100$$

where: S_1 = measured sample concentration; and
S_2 = known sample or duplicate concentration.

The goals for precision are provided in Section 2, Quality Assurance Objectives. When analytes are present at concentrations below or near the quantitation limit, precision will be evaluated using duplicates of a matrix-spike sample (if available).

6.2 Accuracy

Accuracy (bias) is the degree of difference between a measured or calculated value and the true value. Data accuracy will be evaluated using sample recoveries, expressed as the percentage of the true (known) concentration, from laboratory-spiked (including matrix spikes) and from standard reference

materials (i.e., laboratory control standards) generated by the analytical laboratory. Equipment rinsates and laboratory blanks will be analyzed to quantify artifacts introduced during sampling, transport, or analysis which may affect the accuracy of the data. The percentage recovery for spiked samples will be used to evaluate the accuracy of analyses as given by:

$$Recovery(\%) = \frac{A - B}{T} \times 100$$

where A = measured concentration of the spiked sample;
B = concentration of unspiked sample; and
T = amount of spike added.

In addition, the calibration results will be reviewed, if available, to verify that the sample concentrations are accurately measured by the analytical instrument. The project goals for accuracy are provided in Section 2, Quality Assurance Objectives.

6.3 Completeness

Completeness is the percentage of valid measurements (data points) obtained, as a proportion of the number of measurements (data points) planned for the investigation. Completeness is affected by such factors as sample-bottle breakage, and acceptance/non-acceptance of analytical results. Percentage completeness (C) is given by:

$$C(\%) = \frac{V}{P} \times 100$$

where V = number of valid measurements (data points) obtained by the investigation; and

P = number of measurements (data points) planned for the investigation.

Completeness goals are provided in Section 2, Quality Assurance Objectives.

6.4 Representativeness

Representativeness is a qualitative objective, defined as the degree to which data accurately and precisely represent the medium being studied. Representativeness is achieved by collecting a sufficient number of unbiased samples as specified in a sampling plan. Potential bias introduced by sampling methods will be evaluated based on blank results (equipment rinsate, field blanks, filter blanks and wipe blanks). Samples will be collected in accordance with the methods described in the Work Plan and this QAPP to ensure that the samples are representative of the environmental conditions. The samples will be contained, preserved, and stored appropriately, as discussed in Section 4. Laboratory blanks, calibration standards and methods, and QC sample results will also be reviewed, as described in Section 7, to ensure accurate and representative analytical results.

7.0 DATA REDUCTION, VALIDATION, AND REPORTING

Analytical and test results will be reviewed prior to entry into the project database. Review procedures for each type of data are given below.

7.1 Field XRF Data

Field measurements will be obtained from the field XRF instrument used to analyze interior/exterior paint samples. The documentation records will be reviewed for completeness by the operator of the XRF instrument following analysis and once their completeness has been confirmed the results will be reviewed by the Chemist or QAM to verify precision and accuracy of the results. Field duplicates and triplicate measurements, calibration records and results from reference-standard analyses will also be evaluated by the Chemist or QAM to assess whether the precision goals were obtained.

7.2 Environmental Laboratory Measurement Data

Environmental laboratory data will be obtained for the soil, dust and water samples. Laboratory calculations and data review will be performed by the laboratory in accordance with the specified analytical methods. The laboratory will review the results of laboratory QC analyses, instrument calibration and maintenance records, calibrations, and the record of sample custody (including holding times) within the laboratory. The laboratory data packages for soil, dust and water samples will include, at a minimum:

- Copies of the Chain-of–Custody records;
- Sample results and units;
- Date analyzed;
- Sample preparation and analytical method;
- Quantitation limits;
- Laboratory QC results (laboratory control samples, matrix spikes, analytical duplicate, as required by referenced methods); and
- Method blank result (if applicable).

The data package for the ICP data used to confirm the accuracy of soil XRF analyses will also include back-up information concerning instrument calibration, sample preparation, sample run logs, and analytical raw data.

Analytical data packages will be sent directly from the laboratory, in a hard-copy format, to the Chemist. Sample results will also be faxed or e-mailed to Study Director. The data will be reviewed by the Chemist, as described below, and will be reported as described in Section 7.5.

7.3 Environmental Laboratory Data Review and Evaluation

Upon receipt of the soil, dust and water analytical results and data packages from the laboratories, the data will be reviewed by the Chemist or the QAM for accuracy, precision, and completeness. The data will be validated using the Data Validation Checklists provided in Attachment B.

The validation process will include the review of the following items:

- Analyses performed and sample identifications conform to the information on the Chain-of-Custody record;
- Sample holding times met;
- Specified quantitation limits achieved;
- Laboratory QC results (laboratory control samples, matrix spikes, analytical duplicates, XRF standard) meet measurement objectives;
- Target analyte concentrations in method and equipment rinsates; and
- Reproducibility of field duplicate results.

Data that satisfy the quality assurance objectives for this project will be considered usable for comparison to the appropriate trigger criteria. If anomalies or nonconformances are discovered, the laboratory will be instructed to review the submitted data and the methods used to obtain the data. Laboratory QC or field QC sample results that do not meet the QA objectives will be evaluated to determine whether the sample data are usable. Corrective actions, as necessary, will be implemented per the procedures described in Section 9.

7.4 Data Management and Reporting

The electronic database will be the primary tool for tracking environmental testing results and the property's remediation status. Information to be included in the electronic database is described in Section 8 of the Work Plan. Field measurements and laboratory analytical results that have been checked and validated, respectively, will be entered into an electronic database and will include the following:

- Sample location;
- Sample identification;
- Date of sample collecton;
- Analytical method;
- Analytes and concentrations;
- Quantitation limits;
- Laboratory qualifiers; and
- Validation qualifiers (soil, dust and water samples only).

This information, with exception of the validation qualifiers, will either be hand-entered into the database or imported using electronic files supplied by the laboratories. The validation qualifiers will be hand-entered from the validation checklists prepared be the Chemist or QAM. All hand-entered entries will be checked (100 percent) for accuracy. All data merged from electronic files will also be reviewed for accuracy and completeness.

The database will be routinely updated and will allow for data to be used for statistical analyses or calculations. Hard copies of the data packages and validation checklists will also be kept in the individual property file.

8.0 TECHNICAL SYSTEM AUDITS

The purpose of a quality assurance audit is to provide an assessment of the ability of the measurement system to produce data of a quality commensurate with the project's measurement objectives. In addition to documenting the performance of the sampling, analytical and data management systems, the audit provides a mechanism whereby inadequacies in the measurement systems can be identified and necessary corrective actions implemented in a timely manner.

Internal technical systems audits of field and/or laboratory activities may be performed during the course of the project. Internal audits will be performed by the QAM.

An individual audit plan will be developed to provide a basis for each audit. This plan will identify the audit scope, activities to be audited, audit personnel, any applicable documents, and the schedule. Checklists will be prepared by the auditors to structure the review process and document the results of the audit.

8.1 Systems Audits

A technical systems audit is an on-site, qualitative review of the various aspects of a total sampling and/or analytical system. It consists of observations and documentation of all aspects of the measurement effort, including adherence to approved sampling and analysis plan, quality assurance plans and standard operating procedures. A systems audit includes review of record keeping and data handling systems, including:

- Calibration documentation;
- Completeness of data forms and notebooks;
- Data review and validation procedures;
- Data storage and filing procedures;
- Sample custody procedures;
- Documentation of QC data;
- Documentation of maintenance activities;
- Corrective action reporting procedures.

A technical systems audit will include an audit plan, schedule, audit scope and checklists. An audit report will be prepared for the construction oversight manager with recommendations for corrective action, if needed.

8.2 Frequency and Scheduling

The necessity for internal systems audits will be determined by the QAM. Audits will be scheduled at intervals appropriate to assure quality control for the activity type or task in progress and will be planned to coincide with appropriate activities on the project calendar. Such scheduled audits may be supplemented by additional audits for one or more of the following reasons:

- When significant changes are made in the QA/QC plan;
- When it is necessary to verify that corrective action has been taken on a nonconformance reported in a previous audit; or
- When requested by the Study Director.

8.3 Audit Reports

During an audit and upon its completion, the auditor may discuss the findings with the individuals audited, and discuss and agree on corrective actions to be initiated. Minor administrative findings which can be resolved to the satisfaction of the auditor during an audit may not be cited as items requiring corrective action. Findings that are not resolved during the course of the audit, and findings affecting the overall quality of the project, will be noted on the audit checklists and included in the audit report.

Audit results will be reported to the Study Director and filed with project records. The Study Director will submit a reply to the audit report addressing each finding cited, the corrective action(s) to be taken and a schedule for implementation. This reply will be sent to the auditor and will be filed in the project file. The findings cited in the audit and addressed in the reply will be treated as nonconformances and will become subject to review at the time of the next audit.

9.0 CORRECTIVE ACTION

Nonconforming equipment, items, activities, conditions and unusual incidents that could affect compliance with project quality assurance goals will be identified, controlled and reported in a timely manner. For the purpose of this QAPP, a nonconformance is defined as a malfunction, failure, deficiency, or deviation which renders the quality of an item unacceptable or indeterminate. Project staff, a project subcontractor, or analytical laboratory personnel will inform the Study Director or Chemist (as applicable) immediately when a nonconformance is identified or suspected. The Chemist or Study Director will in turn notify the QAM to discuss the nonconformance and identify an appropriate response (i.e., "corrective action").

If the analytical results of laboratory control samples fall outside of the project's control limits, corrective actions will be initiated by the laboratory. The QAM will also review field data and narrative records related to the samples in question for the potential source of the error. If the laboratory cannot correct the situation that caused the nonconformance and an out-of-control situation continues to occur or is expected to occur, the laboratory will immediately contact the Study Director or the QAM. Completion of corrective action should be evidenced by data once again falling within prescribed quality control limits. If an error in laboratory procedures or sample collection and handling procedures cannot be found, the Study Director, or designee, will review the results and assess whether reanalysis or resampling is required.

10.0 QUALITY ASSURANCE REPORTS

Effective management of the environmental sampling effort requires timely assessment and review of field activities which in turn requires effective interaction and feedback between the Study Director and QAM.

The Study Director will be responsible for documenting any conditions or situations that might adversely affect data quality. These conditions should be communicated in writing to the QAM. In addition, routine quality assurance reports may be prepared by the Study Director for the QAM. These reports will include elements such as project activities, modifications to or deviations from the Work Plan and any corrective actions taken, status of unresolved problems and audit results. These reports may be provided as informal memos or other documented presentations.

11.0 REFERENCES

MFG, Inc. and Tetra Tech EM, Inc., 2002. Community Health Program Pilot Study Work Plan, draft dated August 2002, prepared for U.S. Environmental Protection Agency, Denver, CO, August 2002.

EPA, 1998. EPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846, Draft Update IVA.

EPA, 1997. EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Update III.

EPA, 1983. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020.

TABLES

TABLE 2-1

QUANTITATIVE MEASUREMENT OBJECTIVES FOR ANALYSES OF SOIL, PAINT, DUST AND WATER SAMPLES

Sample Matrix (Parameter)	Analytical Method	Precision	Accuracy	Quantitation Limit	Completeness
Soil (Lead and Arsenic)	ICP (EPA Methods 3052 and 6010B)	LCS duplicate RPD<20% MS duplicate RPD <25%	PE sample recovery = 80 to 120% LCS recovery = 80 to 120% MS recovery = 75 to 125%	Pb: 10 mg/Kg As: 5 mg/Kg	95%
Paint (Lead)	XRF (Field)	Triplicate measurement standard deviation $\pm$0.1 mg/cm^2. Reference standard sample replicate deviation less than 0.1 mg/cm^2 or less than 0.3 mg/cm^2 (see Section 5.1.3).	Mean of reference standards within 25% of true value Refer to SOP for Paint Testing and Assessment for calibration verification specifications	0.3 mg/cm^2	90%
Dust collected with air-sampling pump (Lead)	AA (EPA Method 7420 or 7421)	Analytical duplicate RPD <15% Field duplicate RPD <50%	Calibration Verification 90 to 110% LCS recovery = 85 to 115% Filter blank non-detect	400 mg/Kg	90%
Dust wipes (Lead)	AA (EPA Method 7420 or 7421)	Analytical duplicate RPD <15%	Calibration Verification 90 to 110% LCS recovery = 85 to 115% Spike recovery = 80 to 120 %	25 $\mu g/ft^2$	90%
Dust Wipes (Arsenic)	AA (EPA Method 7060 or 7061A)	Analytical duplicate RPD <15%	Calibration Verification 90 to 110% LCS recovery = 85 to 115%	10 $\mu g/ft^2$	90%
Water (Lead)	Graphite Furnace AA (EPA Method 200.9)	Analytical duplicate RPD <20%	Calibration Verification 90 to 110% LCS recovery = 50 to 150% Calibration blank <MDL	5 $\mu g/L$	90%

TABLE 4-1

ANALYTICAL METHODS, HOLDING TIMES, AND QUANTITATION LIMITS

Sample Type	Parameter	Analytical Method (digestion/analysis)	Target Quantitation Limit	Container & Preservation	Storage	Holding Time
Soil[1]	Arsenic	EPA 3052/6010B[2]	5 mg/Kg	clean bags or glass jars; 200 grams	N/A	6 months
	Lead	EPA 3052/6010B[2]	10 mg/Kg			
Interior/Exterior Paint	Lead	EPA 6200[3]	0.3 mg/cm^2 (low-range calibration model)	N/A	N/A	6 months
Dust (filters and wipes)	Lead	EPA 3050B[2]/EPA 7420 or 7421[2]	2,000 mg/Kg (filters)	filter cassettes w/in plastic bags	N/A	6 months
			25 µg/ft^2 (wipes)	wipe container; plastic bag or tube		
Dust (wipes)	Arsenic	EPA 3050B[2]/EPA 7060 or 7061A[2]	15 µg/ft^2 (wipes)	wipe container; plastic bag or tube	N/A	6 months
Tap Water	Lead	EPA 180.1[4]/ EPA 200.9[4]	15 µg/L	1 L plastic, HNO_3 to pH <2 within 24 hours	4±2°C	6 months

[1] Soil samples will be dried and sieved prior to splitting for analysis.

[2] EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Update III, 1997. A complete (hydrofluoric acid) digestion will be performed prior to ICP analysis of soil samples.

[3] EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Draft Update IVA, 1998.

[4] EPA Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, 1983.

N/A = Not applicable

TABLE 5-1

TYPES AND FREQUENCY OF QC SAMPLES COLLECTED WITH ENVIRONMENTAL SAMPLES

Environmental Sample Type	QC Sample Type					
	Equipment Rinsate	Filter/ Wipe Blank	Performance Evaluation Sample	Spike	Field Blank	Field Duplicate
Soil Samples	1 per property	NA	1 per 20 samples	NA	NA	1 per property
Interior/Exterior Paint	see Section 5.1.3					
Dust (filter)	NA	1 per batch of 50	NA	NA	1 per batch of 50	1 per 20 samples
Dust (wipe)	NA	1 per brand	NA	1 per 20 samples	1 per brand	NA
Water	NA	NA	NA	NA	NA	1 per 20 samples

NA = Not applicable/not necessary to collect for the sample type.

ATTACHMENT A

Standard Operating Procedure for Soil Sample Preparation

TECHNICAL STANDARD OPERATING PROCEDURE

Date: August 26, 1999 SOP No. MK-VBI70-05

Title: **Sample Preparation**

APPROVALS:

Author: Morrison Knudsen Corporation Date: August 26, 1999

SYNOPSIS: Provides procedures and instructions for the preparation of soil samples for on-site XRF and off-site laboratory analysis.

Received by QA Unit

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Region 8	RPM	8/27/99
Morrison Knudsen Corp.	QA Coordinator	8/26/99

REV.	DATE	REVISION DESCRIPTION
1	8/4/99	Grinding of bulk soil prior to XRF analysis added
2	8/26/99	Sieving sample to be performed after drying instead of prior to drying

TECHNICAL STANDARD OPERATING PROCEDURE
SAMPLE PREPARATION

1.0 PURPOSE

The purpose of this procedure is to provide instructions to Morrison Knudsen personnel assigned to the VB/I-70 Project and their subcontractors for the preparation of soil samples.

2.0 SCOPE

This procedure covers activities associated with preparation of soil samples for subsequent analysis by X-ray fluorescence spectrometry, inductively coupled plasma spectroscopy, and/or bioavailability tests.

3.0 REFERENCES

Method 6200 Field Portable X-Ray Fluorescence Spectrometry For The Determination Of Elemental Concentrations In Soil And Sediment

Spectrace QuanX Laboratory X-Ray Fluorescence Analyzer Standard Operating Procedure

Standard Operating Procedure for Chain of Custody and Sample Handling, SOP No. MK-VBI70-02

Standard Operating Procedure for Equipment Decontamination, SOP No. MK-VBI70-07

Standard Operating Procedure for Investigation Derived Waste Management, SOP No. MK-VBI70-04

4.0 DEFINITIONS

None

5.0 RESPONSIBILITIES

The **Sample Preparation Technician** will be responsible for overseeing sample receipt and chain of custody both before and after the preparation process, and implementation of the sample preparation process.

The **Field Supervisor** will be responsible for quality and production of field laboratory operations.

The **Site Health and Safety Officer** will be responsible for verifying implementation of this procedure using safe laboratory practices.

The **Field Quality Assurance Coordinator** will be responsible for overseeing proper implementation of the quality control procedures, including tracking of blind standard samples, tracking of confirmation samples for off-site laboratory analysis, and specification of sample labels to be used for blind split samples.

The **Site Manager** will be responsible for ensuring that personnel are properly trained to this procedure.

6.0 REQUIREMENTS

6.1 General

6.1.1 Sample preparation activities shall be performed only in areas designated for each activity.

6.1.2 Eating and smoking are prohibited in all areas of the sample preparation area.

6.1.3 Samples generally will be prepared in batches consisting of twenty field samples.

6.1.4 All non-dedicated equipment used during sample preparation must be decontaminated prior to use as described in the Decontamination SOP (MK-VBI70-07).

6.2 Equipment

Sample drying trays
Permanent Marking pen
General purpose laboratory oven
#10 mesh stainless steel sieve
#60 mesh stainless steel sieve
Sample bags
XRF cups
Mylar
Spatulas
Stainless steel spoon
Analytical balance accurate to 0.1 g, range of 0.1 g to 1000 g
Mortar and pestle, 140 mL or greater (or mill equipped with Burundum cylinders)

6.3 Soil Mixing

6.3.1 Select samples to be prepared. Prior to opening the sample bag, knead the contents to break up soil clumps and mix approximately two minutes or until the soil appears to be well homogenized. If the kneading process produces cohesive clumps, that observation will be noted in the Preparation Log.

6.3.2 Mix by turning the bag end over end slowly a minimum of ten times, then using a large stainless steel spoon, stir the contents of the sample bag thoroughly.

6.4 Bulk Soil Drying

6.4.1 Set the oven temperature to 103-105 C (not to exceed 115 C). Record the oven temperature at least once daily in the Sample Preparation logbook.

6.4.2 Pour approximately 6 ounces of the sample into a pre-labeled (3-XXXXX-R) drying pan and pour the remainder of the soil into a pre-labeled bag for archiving (3-XXXXX-RA) under chain of custody documentation. Spread the sample on the drying tray in an even layer to promote even drying.

6.4.3 Check the oven temperature to verify proper temperature has been reached. Place the drying trays containing the samples into the oven(s). Leave the samples in the oven until completely dry as defined by a stable sample weight. Establish the drying time initially by recording weights for samples with varying soil moisture: 1) before drying, 2) at estimated completion, and 3) following an additional 15 minute drying time to confirm stable weight. Verify sample dryness for all samples by squeezing a portion of the sample between a gloved thumb and forefinger. Sample dryness is indicated by a lack of cohesiveness in the soil. Document the sample drying time for each sample on the Sample Preparation Log.

6.4.4 When samples are dry, remove from the oven and place in the ventilation area. **Before placing samples at the ventilation area, verify that the blower is turned on.**

6.5 Bulk Sieving

6.5.1 Pour the sample from the drying pan onto a #10 sieve attached to a catch pan. Shake the sieve to pass the sample through the sieve into the catch pan. Dispose of any sample that did not pass through the sieve into the waste soil receptacle.

6.5.2 Place the sieved sample into a pre-labeled (3-XXXXX-B) sample bag. Completely seal the bag, then mix by turning the bag end over end slowly a minimum of ten times.

6.5.3 Document the date sieving was performed for each sample in the Sample Preparation Log Sheet.

6.6 Bulk Soil Grinding and Cupping

6.6.1 Using a spatula, stir the contents of the sample bag thoroughly, then transfer approximately 10 grams to the mortar.

6.6.2 Grind the soil using the pestle for ten minutes or until all material is evenly ground to a powder. If larger grained vegetation or soil materials remain, sieve the sample through a #60 sieve.

6.6.3 Using a spatula, fill the pre-labeled (3-XXXXX-B) XRF cup with soil from the mortar, filling cup ½ to ¾ full. Secure a piece of Mylar film over the top of the cup to seal.

6.6.4 Prepare XRF quality control samples as described in Section 6.8.2. Dispose of any unused ground soil into the waste soil receptacle.

6.7 Drying and Sieving Fine Fraction Soil

6.7.1 Selected archived bulk soil samples will be dried at a low temperature and sieved to isolate the naturally occurring fine fraction using a #60 mesh sieve.

6.7.2 Set the oven temperature to 45-48 C (not to exceed 50 C).

6.7.3 Pour approximately 8 ounces of soil onto a pre-labeled (3-XXXXX-RA) drying tray and spread in an even layer to promote even drying. Return the remaining soil to the archive.

6.7.4 Check the oven temperature to verify proper temperature has been reached. Place the drying trays containing the samples into the oven(s). Leave the samples in the oven until completely dry as defined by a stable sample weight. Establish the drying time initially by recording weights for samples with varying soil moisture: 1) before drying, 2) at estimated completion, and 3) following an additional 15 minute drying time to confirm stable weight. Confirm sample dryness for all samples by squeezing a portion of the sample between a gloved thumb and forefinger. Sample dryness is indicated by a lack of

cohesiveness in the soil. Document the sample drying time for each sample on the Sample Preparation Log.

6.7.5 When samples are dry, remove from the oven and place in the ventilation area. **Before placing samples at the ventilation area, verify that the blower is turned on.**

6.7.6 Pour the dried sample onto a #60 sieve attached to a catch pan. Shake the sieve to pass the sample through the sieve into the catch pan. Dispose of any sample that did not pass through the sieve into the waste soil receptacle. Place the sample in the catch pan into a pre-labeled (3-XXXXX-F) sample bag. Completely seal the bag then mix by turning the bag end over end slowly a minimum of ten times. Using a spatula, stir the soil thoroughly and then fill the pre-labeled (3-XXXXX-F) XRF cup with soil from the sample bag, filling cup ½ to ¾ full. Secure a piece of Mylar film over the top of the cup to seal.

6.8 **Quality Control Sample Preparation Procedure**

6.8.1 Sample preparation will be performed in an area separate from the XRF operations. The sample preparation technician who prepares sample batches containing blind quality control samples may not perform analysis on those samples. The XRF analyst will not observe the sample preparation and will not view the preparation logs in order to maintain sample anonymity to the analyst.

6.8.2 Prepare each of following quality control samples at rate of one per twenty field samples by filling two XRF cups with soil (following sample drying, sieving, mixing and grinding procedures):

- One laboratory duplicate, labeled 3-XXXXX-B(or -F)-DUP
- One blind field split, labeled with a unique sample ID from the labels designated for QC samples.

6.8.3 Prepare confirmation samples at a rate specified by the EPA Remedial Project Manager (initially one per three field samples) by transferring approximately 4 ounces from the

prepared field sample bag (following drying, bulk sieving, fine sieving where applicable, and mixing; grinding of confirmation samples is not necessary) into a second bag and labeling the confirmation sample with the identical sample identification (i.e., 3-XXXXX-B or 3-XXXXX-F). The confirmation sample will be submitted under chain of custody to an off-site laboratory for analysis by Method 6010B (ICP) as described in the Chain of Custody and Sample Handling SOP (MK-VBI70-02).

6.8.4 Document the laboratory duplicate in the "Notes" column of the Field Sample Preparation Log. Document the blind field split Sample ID and original Sample ID on the QC Data Sheet for Blind Soil Field Splits.

6.8.5 Prepare blind standards as directed by the Field Quality Assurance Coordinator by filling a pre-labeled XRF cup with soil from the blind standard sample provided. If the standard is not received pre-dried, sieved and ground, the sample will be prepared in accordance with mixing, drying, sieving, and grinding procedures detailed above in Section 6.3, 6.4, 6.5, and 6.6. Label the cup with a unique sample ID from the list of sample labels designated for QC samples. Document the blind standard when prepared on the Performance Evaluation Standard (Blind Standard) QC Data Sheet.

6.8.6 Place 18 XRF cups for a single sample run into a staging container for transfer to the XRF Analyst (the analyst will complete the run with addition of a standard reference material and instrument blank).

6.9 Investigation Derived Waste Management

6.9.1 Remove the sample receptacle from under the ventilation hood and dispose of its contents into the waste soil drum when full and at the end of each day.

6.9.2 Place all non-dedicated sample drying trays, sieves, catch pans, spatulas, and spoons used during sample preparation in the receptacles for equipment decontamination.

7.0 ATTACHMENTS

Field Sample Preparation Logbook Sheet

QC Data Sheet, Blind Soil Field Splits

QC Data Sheet, Blind Performance Evaluation Samples

TECHNICAL STANDARD OPERATING PROCEDURE
SAMPLE PREPARATION

ATTACHMENTS

FIELD SAMPLE PREPARATION LOGBOOK SHEET

QC DATA SHEET, BLIND SOIL FIELD SPLITS

QC DATA SHEET, BLIND PERFORMANCE EVALUATION SAMPLES

VB170 Field Sample Preparation Logbook Sheet

Sample ID	Prep Batch Number	Confirmation Sample	Drying						Sieving			Notes
			Date/Time Drying Begun	Initial Weight	Date/Time Drying Estimated to be Complete	Weight	Date/Time Drying Complete	Final Weight	Date Sieved	Particle Size Fraction		
										Bulk (<2mm)	Fine (<250 µm)	

VBI70 Field Sample Preparation Logbook Sheet

Sample ID	Prep Batch Number	Drying		Sieving			Confirmation Sample (Y/N)	Notes
		Date/Time Drying Begun	Date/Time Drying Complete	Date Sieved	Particle Size Fraction			
					Bulk (<2mm)	Fine (<250um)		

VBI70 QC Data Sheet
Blind Field Split Samples

Date	Sample ID	Sample Class	Original Sample	Prepared By	Notes
		BD			
		BD			
		BD			
		BD			
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		BD			
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VBI70 QC Data Sheet
Blind Standard

Date	Sample ID	Sample Class	Lot Number	Analysis Type		Prepared By
				XRF	Confirmation	
		PE				
		PE				
		PE				
		PE				
		PE				
		PE				
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ATTACHMENT B

DATA VALIDATION CHECKLISTS

Vasquez Boulevard and I-70 Site
Pilot Study Environmental Samples - Data Validation Checklist

MFG Project No.
Sampling Dates:
Sample Type:
Property ID:

Laboratory:
Lab. Project No.:
Reviewer:

	Yes	No	NA

Data Completeness

Is the chain-of-custody form complete and correct?

Were all requested analyses performed?

Were additional analyses requested and performed?

Were any sample names changed or incorrect?

Samples affected *Qualification action*

Holding Times

Were samples properly preserved? (NA if no preservation required)

Were holding times met for analysis and reanalysis?

Samples affected *Qualification action*

Instrument Calibration (ICV and CCV)

Are initial and continuous calibration verifications (ICV and CCV) within limits (90 - 110%)?

Recalculate one percent recovery [%R = found/true)*100]. Lab calculation correct?

Samples affected *Qualification action*

Calibration Control Blanks (ICB and CCB)

Were initial control blank (ICB) and continuing calibration blank (CCB) analyzed after ICV and CCV?

Are ICB and CCB within limits?

Samples affected *Qualification action*

Matrix Spikes/Matrix Spike Duplicates

Were field " or lab " spike samples analyzed?

Were percent recoveries (50 to 150%) and relative percent differences (±35%) within limits? (see attached for calculation)

Samples affected *Qualification action*

Method Verification

Are laboratory control sample (LCS) recoveries (80 to 120%) and relative percent difference (±35%) results within limits?

Are preparation blank results within limits?

Samples affected *Qualification action*

Compound Identification and Quantitation

Were any samples diluted?

Were project-specified reporting limits met?

Were laboratory supplied data qualifiers present where needed?

Samples affected *Qualification action*

Equipment Blank

Were analytes detected in the equipment blank?

List analytes and concentrations:

Samples affected *Qualification action*

Field Duplicates

Was a field duplicate sample collected?

What is the relative percent difference in results (each parameter)? (see attached for calculation)

Samples affected *Qualification action*

Comments:

Calculation results (RPDs, % recovery, etc.):

Signature (data validator):_____
Date:_____

Guidelines:

1) USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, February 1994.
2) MFG, Inc., 2002, Community Health Program Pilot Study Work Plan

Calibration Control Blanks:
Sample results >MDL but <5 times the amount in any blank should be U qualified.

Data Qualifier Definitions:
U: parameter analyzed but not detected above the reported value (i.e., sample detection limit).
UJ: parameter analyzed but not detected above the method detection limit, and reported value is an estimated value which may be inaccurate or imprecise
J: estimated result value
R: result rejected for use (parameter may or may not be present)

Validation Flag Results

Sample ID/Lab Sample ID	Parameter	Result	Units	Flag

Attachment D
Health and Safety Plan

Vasquez Boulevard and I-70 Superfund Site

HEALTH AND SAFETY PLAN FOR FIELD WORK TO SUPPORT REMEDIAL DESIGN

September 2002

Prepared for:

The Environmental Protection Agency

Prepared by:

MFG, INC.
consulting scientists and engineers

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Boulder, Colorado 80301
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FAX 447-1836

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LIST OF ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
CFR	Code of Federal Regulations
HASP	Health and Safety Plan
HEPA	High Efficiency Particulate Air
HSO	Health and Safety Officer
IDLH	Immediately Dangerous to Life and Health
MSDS	Material Safety Data Sheet
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
PID	Photo Ionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
RPP	Respiratory Protection Program
FS	Field Supervisor
TLV-STEL	Threshold Limit Value - Short Term Exposure Limit
TLV - TWA	Threshold Limit Value - Time Weighted Average

1.0 INTRODUCTION

1.1 Purpose of HASP

This Health and Safety Plan (HASP) establishes policies and procedures to protect field personnel from the potential hazards posed by activities to support remedial design at the Vasquez Boulevard and I-70 Superfund Site (VB/I-70) (Figure 1). This HASP assigns personnel responsibilities, prescribes mandatory operating procedures, establishes personal protective equipment requirements, and details actions to be taken during a Site emergency. This HASP has been prepared to comply with the requirements of 29 CFR 1910.120 (b)(4).

1.2 Site Location and Background

The Site comprises an area of approximately 4 square miles in Denver, Colorado. A site location map is presented as Figure 1.

1.3 Scope of Work

Principal field activities to support remedial design are residential investigations, which include:

- Soil sampling
- Interior and exterior paint sampling
- Interior dust sampling using wipe and vacuum methods
- Tap water sampling (to be conducted by residents)
- Resident interviews

1.4 Project Personnel

The provisions of this HASP are mandatory for all personnel assigned to the project. A copy of this HASP will be made available to all MFG personnel, contractors, subcontractors and authorized visitors that may enter the Site to perform field work to support remedial design; said personnel will complete the Safety Compliance Agreement Form found in Attachment A.

MFG has developed a Corporate Health and Safety Program, to comply with the requirements of 29 CFR 1910.120 (MFG, 2002). The written MFG Corporate Health and Safety Program is available upon request to all MFG employees, clients, contractors and subcontractors. Relevant sections of the Corporate Health and Safety Program have been incorporated into this HASP.

1.5 HASP Revisions

The procedures presented herein are intended to serve as guidelines. They are not a substitute for the sound judgment of on-site personnel. Work conditions may change as the project progresses. As appropriate, addenda to the HASP will be provided by the Project Manager. Prompt notification of changing work conditions requiring possible modification of this HASP is the responsibility of the Field Supervisor. Additional field tasks with unique hazards or risks may also require addenda to this HASP. In any event, no changes to this HASP will be implemented without prior approval of the Field Supervisor or the Project Manager.

Appendix B of this HASP will be reserved for HASP addenda. Addenda to the HASP will be added to Attachment B as needed during the course of the project. Each person with a copy of this HASP will be provided with any addendums. A list of those persons who have a copy of this HASP will be kept by the Project Manager in the project files.

2.0 KEY PERSONNEL

This section describes the roles and responsibilities of key personnel relative to Health and Safety.

2.1 Key Organization Information

Administrative information concerning this HASP and key personnel are listed below.

Date Prepared:	July 16, 2002		
Project Title:	Vasquez Blvd. and I-70 Superfund Site		
MFG Project Number:	010107x		
Site Address:	Vasquez Blvd. and I-70, Denver, Colorado		
Site Contact Phone Number:	None.		
Site Contact:	Bonnie Lavelle		
MFG Project Manager:	Andy Koulermous		
MFG Field Supervisor/			
Site Health and Safety Officer	Dave Colvin		(303)588-0997
MFG Corporate			
Health and Safety Director:	Patricia Wickham		(303) 447-1823
Nearest Hospital:	Denver Health, 3216 High Street		
Plant City Police:	911		
Plant City Fire Department:	911		
Emergency Medical Service (ambulance):	911		
National Poison Control:			(800) 222-1222
National Response Center (24 Hours):			(800) 424-8802
Centers for Disease Control:		Day	(404) 329-3311
		Night	(404) 329-2888
U.S. EPA Hotline (24 Hours):			(800) 621-3191

2.2 Organizational Responsibilities

2.2.1 Project Manager

The Project Manager (PM) will coordinate all site activities for the project. The PM will have the responsibility to interface with field personnel, the EPA, and any contractors and subcontractors on any health and safety issues, as appropriate. Typically all health and safety issues will be handled by onsite personnel as described in the following sections.

The PM's responsibilities include the following:

- Providing technical input for the pre-entry briefing with field personnel;
- Interfacing between respondent parties, subcontractors and MFG regarding health and safety issues which might arise;
- Initiating occasional site audit(s), as appropriate, to verify adherence to the site safety requirements; and
- Verifying that all MFG employees under his leadership work in a safe manner according to MFG policies and this HASP.

2.2.2 Field Supervisor/Health and Safety Officer

The Field Supervisor/Health and Safety Officer (FS/HSO) will be designated as the onsite MFG personnel responsible for all health and safety activities. The FS/HSO will have the responsibility for implementation of the HASP during actual field operations. His/her responsibilities include the following:

- Conducting the pre-entry briefing with field personnel;
- Informing personnel involved in the field operations of the proper procedures during emergencies;
- Immediately reporting any unusual or unsafe conditions;
- Verifying that all MFG employees under his leadership work in a safe manner according to MFG policies and this HASP;
- Providing a copy of the HASP to all subcontractors and third party contracts, and informing them or their representatives of any potential safety hazards that exist onsite or that may be identified during normal operations;
- Observing work party members for symptoms of overexposure or stress;
- Providing first aid onsite, if necessary;
- Performing site audits to verify adherence to the requirements of the HASP; and

- Modifying health and safety equipment or procedures based on data gathered at the worksite.

2.2.3 MFG Corporate Health and Safety Director

The MFG Corporate Health and Safety Director will provide the following functions in support of field activities:

- Review this HASP and all addenda thereto;
- Be available for consultation with the FS/HSO;
- Modify health and safety equipment or procedures based on data gathered at the Site;
- Provide review and critique of emergency response actions required during performance of field activities, if any;
- Assist the Field Supervisor in ensuring that proper health and safety equipment is available for the project; and
- Approve personnel to work on the Site with regard to medical examinations and health and safety training.

2.2.4 Contractors

MFG subcontractors and third party contractors shall bear the ultimate responsibility for all matters dealing with safety in the performance of their work. This responsibility includes the safety of all persons and property and any and all employees of subcontractors that may perform work on their behalf. This requirement will apply continuously regardless of time or place, and will in no way be altered because MFG personnel provide general directions as to the location where work should be performed and/or samples taken. The contractor, their employees and any and all employees of subcontractors that may perform work on their behalf may be required to work with potentially hazardous substances. The Project Manager will, to the best of his ability, inform subcontractors or their representatives of any potential electrical, fire, explosion, health, or other safety hazards that have been identified during operations. A copy of this HASP shall be made available to all contractors working at the Site.

3.0 TASK SAFETY AND HEALTH RISK ANALYSIS

The anticipated site activities potentially include both physical and chemical hazards. The sections below discuss the hazards that could potentially be encountered during the course of the project. As described previously, the scope of work entails collection of surficial soil samples from residential yards

3.1 Physical Hazards

Physical hazards at the Site can be posed by:

- Heat/Cold Stress;
- Heavy Weather;
- Dangerous Animals, Insects, and Plants;
- Slip, Trip, and Fall;
- Overhead Utilities;
- Underground Utilities;
- Fire; and
- Traffic.

Injuries that may result from these physical hazards can range from simple slip-trip-fall types of accidents to casualties, including fatalities due to moving heavy equipment or electrocution. Injuries resulting from physical hazards can be avoided through the adoption of safe work practices and employing caution when working with machinery.

All field personnel shall be conscious of their work environment and should notify the Project Manager or other appropriate supervisory personnel of any unsafe conditions. The PM will be responsible for informing all workers of any physical hazards related to the Site. All field personnel should also familiarize themselves with other contractors safety procedures. The above mentioned physical hazards are discussed in the following sections.

3.1.1 Heat/Cold Stress

Adverse weather conditions are an important consideration when planning and conducting site operations. Hot or cold weather can cause physical discomfort, loss of efficiency, and personal injury. Whenever ambient air temperatures are above 70°F or below 50°F, the following protocols will be observed.

When air temperatures exceed 70°F, the following general practices will be followed:

- Site workers should consume sufficient fluids to remain hydrated;
- In hot weather, activities which will require the use of protective clothing will be performed in the early morning or late afternoon, when practical; and
- In hot weather, the number of workers required to wear protective clothing will be minimized, as practical.

Symptoms of heat stress are: cramping; pale or clammy skin; tiredness or weakness; headaches, nausea or dizziness; fainting; high body temperature; hot, red or dry skin; rapid, weak pulse; or unconsciousness. If symptoms of heat stress are noted for a worker, the worker will take a break in an air-conditioned building or shaded area and be given cooled drinks. The worker should rest for at least five minutes in an air-conditioned building or in the shade before resuming work.

When air temperatures are below 50°F, cold stress will be monitored for all workers. The most important factor in the prevention of cold stress is the wearing of adequate clothing. The FS/HSO will be responsible for informing all workers if their protective clothing is inadequate. In addition, when working in cold temperatures the following procedures will be observed:

- Frequent breaks or rest periods will be provided and workers will have a shelter from wind and moisture;
- Hot drinks may be provided; and
- Opportunities to change out of wet clothing or to don additional clothing will be provided.

Workers will self-monitor themselves and co-workers for signs of cold stress. Symptoms of cold stress are: shivering; numbness; low body temperature; drowsiness; and weakness. Workers with

symptoms of cold stress will take at least a ten minute break in a heated building or vehicle and drink warmed liquids (i.e., hot cocoa, soup, etc.) before resuming work.

3.1.2 Heavy Weather

It is an MFG policy that fieldwork be conducted under safe conditions. Rain, snow and/or high wind conditions may occur during the time period of a scheduled work activity, depending upon the location of a given jobsite.

All employees will be trained in the hazards of exposure to cold and/or wet conditions. Protective clothing for wet conditions will be utilized as necessary. Heavy rains, high winds or other weather conditions may result in the cessation of site activities, at the discretion of the Project Manager or Field Supervisor.

3.1.2.1 Lightning and Thunderstorms

Outdoor operations will be suspended when lightning is within a 15 second count of the site (i.e., the time difference between seeing a lightning strike and hearing the sound). High profile equipment operation, such as drill rigs, shall be suspended when lightning is within 30 seconds of the site. Equipment operators shall stop their equipment and park it safely before heading for shelter. No personnel will be left on the ground in an exposed location. Preferred shelter during thunderstorms is a permanent building. Personnel may also take shelter in trailers or low profile rubber tired equipment (e.g., pickups). Avoid driving pickups or any other equipment, except to help evacuate personnel.

Thunderstorms always have the potential for down bursts and hail. Weather forecasts should be monitored frequently for changing weather conditions. Work may resume after a 30-minute period without lightning occurring within the 15 or 30 second count specified.

3.1.2.2 Tornadoes

The Field Supervisor will ensure that a dedicated watch is posted during periods of tornado watch or warning. Personnel will be evacuated to permanent structure when necessary. During tornado warnings, refuge should be sought in buildings under archways, tables or in closets below ground level or

on the main floors. If the tornado is too close to evacuate to a permanent structure, refuge should be sought in low areas such as ditches. Field Supervisors must always be aware of changing weather conditions.

3.1.2.3 Snowy Weather, Ice Storms and Blizzards

Extra care must be taken by site workers during snowy weather. Adequate protective clothing, including insulated, rubber, steel-toed boots must be donned. Site workers must be allowed rest periods in warm shelters at regular intervals. Vehicle speeds on site will be limited to below 10 mph during snowy conditions. All work shall be suspended under blizzard conditions and site workers shall immediately seek warm, sturdy shelters, such as buildings.

3.1.3 Dangerous Animals, Insects, and Plants

The Site location consists of 4 square miles in Denver. In warm months, workers must be prepared for mosquitoes, ticks, chiggers and other insects. At the end of the workday, workers should check their legs and scalp for ticks or other insects.

Workers should always be aware of their environment. The work area is known to be habitat for poisonous snakes, raccoons, skunks, and porcupines. Workers should be wary of dogs and other domesticated animals.

Animal bites and insect stings are usually nuisances (i.e., localized swelling, itching, and minor pain) that can be handled with first-aid treatments. The bites of certain snakes and spiders contain sufficient poison to warrant medical attention. There are diseases that can be transmitted by insect and animal bites. Examples are Lyme disease (tick), rabies (mainly dogs, skunks and foxes), malaria, and equine encephalitis (mosquito). The greatest hazard and most common cause of fatalities from animal bites, particularly from bees, wasps, and spiders, is a sensitivity reaction. Anaphylactic shock due to stings can lead to severe reactions in the circulatory, respiratory, and central nervous systems, which can also result in death.

In addition, the project site is located in a geographic area where Lyme disease and rabies are possible. Lyme disease is spread primarily by a very small tick – the deer tick. It can be found near

wooded areas, tall grass and brush. Although the disease is rarely fatal, it can cause flu-like symptoms, arthritis, heart arrhythmia's, facial palsy, severe headaches, and loss of sensation. Protection against the tick consists of wearing clothing that covers the whole body, tucking pant legs into boots or socks and tucking a long-sleeve shirt into pants. A white Tyvek is recommended for protection. Use of repellents containing DEET is also effective. It is also important to frequently check for the ticks, which are about the size of a period on this page. Some warning signs include a "bull's eye" rash that may appear days to weeks after the bite, flu-like symptoms, swelling and pain in joints and, less common, heart arrhythmia, weakness in legs, facial paralysis and numbness. If employees feel they may have contracted the disease, they must notify the Corporate Health and Safety Director.

The most dangerous toxic effects from plants are due to ingestion of nuts, fruits, or leaves. Consequently, personnel are prohibited from eating any fruits, nuts, or other plant material, which may grow on the site. Of more concern to response personnel are certain plants including poison ivy, poison oak, and poison sumac, which produce adverse effects from direct contact. The usual effect is dermatitis, an inflammation of the skin. The protective clothing and decontamination procedures used for chemicals reduce the exposure risk to the plant toxins. Cleaning the skin thoroughly with soap and warm water immediately after contact will reduce risk.

3.1.4 Slip, Trip and Fall

Protection from slip, trip and fall hazards will be provided through standard safety procedures including good housekeeping. Removing equipment and debris, and taking general precautions during site operations will be standard operating procedures. Workers will be apprised of any potential trip hazards through regularly scheduled health and safety meetings. Whenever possible, trip and fall hazards will be eliminated or clearly identified with yellow "caution" tape. Impalement hazards to workers will be neutralized as soon as they are identified.

3.1.5 Overhead Utilities

Before Site activities begin, all overhead utilities will be identified and field verified. As necessary, utilities will be deactivated, or operational procedures and site logistics will be established to

avoid overhead lines. This will be the responsibility of the contractor and will be approved by the PM. The contractor will be responsible for operation of equipment in a safe manner and follow the relevant regulations of 29 CFR 126.550. These regulations include, but are not limited to:

- All electrical equipment and lines shall be de-energized;
- Assume that all overhead lines are energized unless de-energized by the person owning the line or the electrical utility authorities indicate that it is not an energized line and it has been visibly grounded; and
- No hoisted loads shall be left unattended.

The deactivation of utilities, when necessary, should be certified by the proper utility company personnel and the certification record retained. If operation near overhead lines is necessary, Table 1 provides minimum clearance that is required for specific lines.

3.1.6 Underground Utilities

Before drilling activities begin, all utilities (i.e., electricity, natural gas lines, water lines, sewer lines, etc.) should be identified and deactivated as needed. If possible, natural gas lines should be purged to remove all potentially explosive gas. The deactivation of utilities, when necessary, should be certified by the proper utility company personnel and the certification record retained. Location of the utilities and any deactivation will be the responsibility of the contractor and will be coordinated with the PM.

3.1.7 Fire Prevention

Fire extinguishers shall be provided in the field vehicle and shall be available onsite. All extinguishers will be inspected, serviced, and maintained. Inspections shall be recorded on the inspection tag attached to each extinguisher.

3.1.8 Traffic

Vehicle traffic will maintain a safe speed while operating on site. Occupants of any MFG vehicle shall wear seatbelts at all times. Vehicles and equipment will be equipped with the safety procedures

outlined in 29 CFR 1926.601. Heavy equipment will be equipped with an adequate audible warning device and have a reverse sign alarm audible above the surrounding noise level. Precautions will be made to warn foot traffic or other vehicles as necessary.

3.2 Chemical Hazards

Results from previous sampling performed at the Site indicate that several chemical, or toxic, hazards may be encountered at the Site during field activities. These hazards include:

- Lead
- Arsenic; and
- Other chemical contaminants of concern may be encountered during the course of the site activities.

MSDSs for these contaminants of concern can be found in Attachment D.

Chemical substances in gaseous, liquid, or solid form can enter the unprotected worker by inhalation, skin absorption, ingestion, or through a puncture wound (injection). A contaminant can cause damage at the point of contact or can act systemically in different parts of the body.

Chemical exposure by inhalation is a concern since the lungs are extremely vulnerable to chemical agents. In addition, substances can pass through lung tissue into the bloodstream and other susceptible areas of the body. Since some toxic chemicals are not detectable by human senses, their toxic effects may not produce any immediate symptoms. Respiratory protection is therefore extremely important if there is a possibility that the worksite atmosphere may contain such hazardous substances.

The skin and eyes also represent important routes of exposure. Some chemicals directly affect the skin, while others may pass through the skin into the bloodstream where they can be transported to other vulnerable organs. Skin absorption is enhanced by abrasions, cuts, heat, and moisture. The eye is particularly vulnerable because airborne chemicals can dissolve on its moist surface and be carried to the rest of the body via capillaries located very close to the surface of the eye. Protection against skin and eye contact may be provided by:

- Wearing protective equipment (i.e., Tyvek coverall suits);

- Wearing protective safety glasses or goggles;
- Avoiding the use of contact lenses in contaminated atmospheres since they may trap chemicals against the eye surface;
- Keeping hands away from the face; and
- Minimizing contact with liquid and solid chemicals.

Inadvertent ingestion can occur as a result of personal habits such as chewing gum or tobacco, drinking, eating, smoking cigarettes, and applying cosmetics. These practices may provide a route of entry for chemicals and are restricted.

Occupational guidelines for contaminants of concern at the Site are presented in Table 2. Permissible Exposure Limits (PELs) are enforceable standards promulgated by OSHA and represent the 8-hour time-weighted average above which workers may not be exposed.

Threshold Limit Values-Time Weighted Average (TLV-TWA) values are the time-weighted average concentration for a normal 10-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect. Threshold Limit Value-Short Term Exposure Limit (TLV-STEL) values are the concentrations to which workers can be exposed intermittently for short periods of time (15 minutes or less) without suffering from: 1) irritation; 2) chronic or irreversible tissue damage; or 3) narcosis of sufficient degree to increase the likelihood of accidental injury, impair self-rescue or materially reduce work efficiency, provided that the daily TLV-TWA is not exceeded. TLV-TWA are established by the American Conference of Governmental Industrial Hygienists (ACGIH, 1995) and provide the basis for safety regulations of OSHA. The Immediately Dangerous to Life and Health (IDLH) limit (NIOSH, 1999) is defined as the maximum concentration of toxic substance from which escape is possible without irreversible harm should a worker's respiratory protective equipment fail.

3.2.1 Lead

Lead is a heavy, ductile, soft, gray solid in pure form. Routes of entry include inhalation, skin and/or eye contact, and ingestion. Symptoms of exposure include irritated eyes, loss of appetite, headache, tremors, anxiety, insomnia, pallor, or metallic taste in mouth. Target areas from exposure include the blood, gastrointestinal tract, central nervous system, and the gingival tissue.

3.2.2 Arsenic

Elemental arsenic is ordinarily a steel gray metal-like material that sometimes occurs naturally, although it is usually found combined with other elements in the environment. Routes of entry include inhalation, skin and/or eye contact, and ingestion. Symptoms of exposure include irritation of your stomach and intestines, stomach ache, nausea, vomiting, fatigue, abnormal heart rhythm, diarrhea, impaired nerve function causing a "pins and needles" sensation in your hands and feet, sore throat and irritated lungs. Target organs from exposure include the skin, gastrointestinal tract, liver, and respiratory tract.

3.2.3 Other Contaminants of Concern At The Site

Other contaminants may be encountered during the course of the site activities. If unusual odors or conditions are encountered, personnel should suspend work activities and contact the PM or Corporate Health and Safety Director for guidance before proceeding.

3.2.4 Other Miscellaneous Items

The major chemical hazards have been discussed above, however, other potential chemical hazards may be encountered during site activities. One potential chemical hazard is laboratory packing chemicals or acid preservatives that may be required for sampling. Also, chemicals used during decontamination, such as Alconox, are irritating to the skin and respiratory system and should be handled appropriately.

In addition to chemical concerns, paint testing on the site will be done using a shielded radiation source in an enclosed x-ray fluorescence spectrometer (XRF). The unit will only be used by a technician trained in radiation safety and safe use of the XRF. The XRF and the most recent leak test results will remain in the control of the trained technician at all times.

3.2.5 General Precautions

If signs of contamination different from those addressed in this HASP are encountered, such as visible soil stains or unusual odors, stop all work in the area, barricade or otherwise isolate the area, and immediately contact the Project Manager. Protection of worker health and safety shall be the first priority. Continuation of work in the area and the amount of additional personal protective equipment, if any, shall be determined by the Project Manager. Other precautions to be undertaken to provide a safe work place on this project where the potential for chemical exposure may exist include:

- No smoking, eating, or drinking in areas where contaminants may be present;
- Avoid the area immediately downwind of any drilling activities;
- Contact with contaminated materials, i.e., groundwater, should be minimized through the knowledge of site conditions and the location of potential contamination based on previous site investigation reports; and
- Adequately barricade or mark-off all work zones to provide for public safety.

4.0 PERSONNEL TRAINING REQUIREMENTS

4.1 General Training

Prior to initiation of site activities, all MFG field personnel shall have completed an initial 40 hour Hazardous Materials Health and Safety Course and 8-hour annual refresher course(s), as appropriate. All field personnel shall also have a minimum of three days of actual field experience under the direct supervision of a trained, experienced supervisor.

The Field Supervisor shall have completed at least eight additional hours of specialized supervisor training as per 29 CFR 1910.120 (e)(4). All courses shall have been conducted by a qualified trainer as specified in 29 CFR 1910.120 (e)(5). These courses should cover chemical hazards, hazard recognition, hazard assessment and personal protective equipment. If necessary, the site Health and Safety Officer (HSO) will have been trained in standard first aid measures and CPR.

All personnel who may participate in the site activities shall be required to have completed appropriate training as specified in 29 CFR 1910.120 (e)(3) prior to the initiation of site activities. The supervisor training requirement will also apply to the subcontractor supervisors. The subcontractor shall provide MFG with copies of written certificates documenting said training. Copies of training certificates for on-site personnel will be kept at the Site in the possession of the PM during the performance of site activities.

4.2 Site Informational Programs

Prior to the initiation of each phase of field work, all personnel who will participate in the site investigation shall attend a pre-entry briefing. The pre-entry briefing will review information contained in this HASP, including:

- Names of personnel responsible for site safety and health;
- Safety and health concerns, including physical and chemical hazards present at the Site;
- Use of personal protective equipment;
- Work practices by which the employee can minimize risks from hazards;
- Engineering controls and safe use of equipment on site;

- Medical surveillance requirements, including recognition of symptoms and signs which might indicate overexposure to hazards;
- Site control measures;
- Site decontamination procedures;
- Emergency response procedures; and
- Spill containment procedures.

In addition, all persons participating in field activities shall be required to read this HASP and sign the safety compliance agreement form found in Attachment A. Information discussed at the pre-entry briefing will be reinforced, in turn, during tailgate safety meetings (see below). Additional pre-entry briefings may be required for additional phases of work or if new personnel are assigned to the project.

Tailgate safety meetings will be conducted as necessary, or whenever new personnel arrive and/or when a unique work assignment warrants employee training. Initial tailgate safety meetings will be conducted by the Field Supervisor. These meetings will cover the projected work for the day or the specific task and will review and reinforce good safe work practices (e.g., proper protective clothing, effective deterrents of heat stress, etc.). Information discussed at the tailgate safety meetings may be revised and updated, based on any new data obtained pertaining to Site characterization and analyses.

An attendance record will be kept for the pre-entry briefing and for all subsequent tailgate safety meetings. In addition to documenting the persons in attendance, these records will include the date and time of the meeting and the subjects covered. A sample safety meeting attendance form is included in Attachment C.

5.0 PERSONAL PROTECTIVE EQUIPMENT PROGRAM

5.1 Personal Protective Equipment Program

MFG has developed and implemented a personal protective equipment (PPE) program to comply with the requirements of 29 CFR 1910.120 (g)(5). This PPE program contains procedures for:

1) PPE use and limitations;

2) PPE maintenance and storage;

3) PPE decontamination and disposal;

4) PPE training and proper fitting;

5) PPE donning and doffing;

6) PPE inspection prior to, during, and after use;

7) Evaluation of the PPE program effectiveness; and

8) Limitations during temperature extremes and heat stress, and other appropriate medical considerations.

The PPE program also includes a respiratory protection program (RPP) that complies with 29 CFR 1910.134 and EPA Order 1440.1. The RPP contains procedures for documentation of respirator fit testing. The MFG personal protective equipment program is included herein as Attachment E. Copies of OSHA training and refresher course training documentation for onsite personnel will be kept by the Project Manager in the project files.

In designating the level of PPE for the site activities, the degree of risk for the four basic routes of exposure (inhalation, skin absorption, ingestion, and eye or skin contact) to potentially hazardous substances was evaluated. When the established permissible exposure levels (PELs) are exceeded, certain procedures will be taken to reduce potential exposure. Engineering controls are to be implemented first whenever possible. When engineering controls are not possible or prove to be insufficient, PPE will be used to limit potential exposure.

5.2 Personal Protective Equipment Levels

The following sections describe the levels of personal protection for field work at the Site. These levels are based upon the physical and chemical hazards at the Site (Section 3.0). All site field activities are anticipated to be performed in Level D or modified Level D protection. The level of personal protection worn by field personnel will be defined, controlled, and implemented by the PM. Protection may be upgraded or downgraded by the PM, as deemed necessary throughout the project.

5.2.1 Level D Personal Protection

Level D personal protective equipment is basic and includes the following:

- Blue jeans, cotton t-shirt with 4" sleeves;
- Work gloves;
- Steel-toe work boots (conforming to ANSI Standard Z 41.1); and
- Hard hat (conforming to ANSI Standard Z 89.1).

5.2.2 Modified Level D Personal Protection

Modified Level D personal protective equipment may include the following:

- Blue jeans, cotton t-shirt with 4" sleeves;
- Work gloves (disposable nitrile or cotton, depending on task);
- Steel-toe work boots (conforming to ANSI Standard Z 41.1) with rubber covers, if necessary;
- Hard hat (conforming to ANSI Standard Z 89.1);
- Safety glasses or sunglasses (conforming to ANSI Standard Z 87.1);
- Hearing protection (when excessive noise greater than 85 dBa is present); and
- Disposable Tyvek coveralls (exchanged when heavily soiled or after breaks, at least once per work day).

5.3 PPE Deviation/Modification

Protection levels may be upgraded, downgraded, or modified as deemed necessary by the FS/HSO based upon work task or site-specific, safety-related factors such as:

- When excessive noise levels exceed 85 dBa;
- Change of season/weather;
- When temperature extremes or individual medical considerations (i.e., heat stress, medication, etc.) limit the effectiveness of PPE; or
- Contaminants other than those previously identified are encountered.

5.4 Limitations of PPE

PPE ensembles designated for use during work tasks have been selected to provide protection against contaminants at known or anticipated concentrations in soil or water matrices. However, no protective garment, glove, or boot is chemical-proof, nor will it afford protection against all types of chemicals. Permeation of a given chemical through PPE is a complex process governed by contaminant concentrations, environmental conditions, physical condition of the protective garment, and the resistance of a garment to a specific contaminant. Chemical permeation may continue even if a garment is resistant to a specific contaminant and may continue even after the source of contamination has been removed from the garment.

In order to obtain optimum usage from PPE, the following procedures are to be followed by all site personnel using PPE:

- When using disposable Tyvek coveralls, don a clean, new garment after each rest break or at the beginning of each shift;
- Inspect all clothing, gloves, and boots both prior to and during use for:
    - Imperfect seams;
    - Nonuniform coatings;
    - Tears; and
    - Poorly functioning closure.
- Inspect reusable garments, boots, and gloves both prior to and during use for:
    - Visible signs of chemical permeation;
    - Swelling;
    - Discoloration;
    - Stiffness;

- Brittleness;
- Cracks;
- Any sign of puncture; and
- Any sign of abrasion.

Reusable gloves, boots, or coveralls exhibiting any of the characteristics listed above will be discarded. PPE used in areas known or suspected to exhibit elevated concentrations of contaminants will not be reused and will be discarded.

5.5 Donning of PPE

A routine will be established and followed at the Site for donning PPE. The procedures will be discussed in detail during the Site safety meeting before starting the project and briefly during periodic Site safety meetings.

Before wearing any level of PPE, it will be checked that it is in proper condition for the purpose for which it is intended. Also, workers with any minor injuries and/or openings in the skin surface, such as cuts and scratches, will be attended to in order to protect such areas which may potentially enhance exposure effects. Workers with large cuts, rashes, or other such skin damage will not be allowed to don PPE.

6.0 MEDICAL SURVEILLANCE REQUIREMENTS

MFG has developed and implemented a medical surveillance program to comply with the requirements of 29 CFR 1910.120 (f). This program requires annual medical monitoring (including pulmonary function evaluation) for all MFG field personnel. Records for this program are kept in compliance with the requirements of 29 CFR 1910.120. These records include:

- The name and social security number of the employee;
- Physician's written opinions, recommended limitations, and results of examinations and tests;
- Any employee medical complaints related to exposure to hazardous substances; and
- A copy of the information provided to the examining physician by the employee.

The MFG Medical Surveillance Program is reproduced in Attachment F. Subcontractors will be required to have medical surveillance programs that comply with 1910.120 (f).

7.0 SITE CONTROL MEASURES

The site control measures program is designed to minimize the exposure of personnel to potentially hazardous substances and/or situations. This objective will be accomplished by the establishment of work zones, the proper decontamination of personnel and equipment, and proper maintenance of safety equipment.

7.1 Safe Work Practices

The following general safe work practices will apply during site activities:

- Personnel will not eat, chew gum or tobacco, smoke, take medicine or perform any other practice that increases the likelihood of hand-to-mouth transfer of potentially hazardous substances from gloves, unwashed hands or equipment.
- No one is to carry "strike-anywhere" matches or cigar/cigarette lighters.
- Personnel will stand upwind of all intrusive activities involving disturbance of the ground surface (e.g., drilling).
- Breaks will be offered to all site workers. A five-minute break per hour may be taken by any worker, although it is not mandatory.

First aid supplies and water will be located in the field vehicles.

7.2 Site Security/Fencing

The Site is not fenced. It is located in an urban Denver area.

7.3 Safety Equipment Maintenance

All safety equipment will be checked on a routine basis. This equipment includes such items such as barricades, fire extinguishers, and any safety warning signs posted throughout the Site.

7.4 Disposal of Waste

Following completion of site activities, gloves and other disposable items will be returned to the MFG office for pick up and disposal at a municipal waste landfill. Water from sampling, or decontamination operations will be contained on-site in 5 gallon buckets and disposed of at the MFG office.

7.5 Sanitation

An adequate supply of potable water will be provided for all site workers in portable containers. Worker-specific toilet and washing facilities are not located at the Site. Such facilities are accessible at public buildings throughout the site.

8.0 DECONTAMINATION PLAN

8.1 Personnel Decontamination

Decontamination and maintenance of personal protective equipment is required for proper functioning of the equipment. At a minimum, nitrile gloves shall be replaced daily or after breaks; if they become damaged, they shall be replaced immediately.

The decontamination areas will be established prior to initiation of field activities, and the exact decontamination procedures will be established at that time based on field conditions, space considerations, etc. The above decontamination procedures apply only to activities where modified Level D PPE is required (e.g., intrusive activities). For other activities, such as walk arounds or site visits, a less rigorous decontamination procedure may be practiced, such as a thorough dry scrubbing of boots, etc.

8.2 Equipment Decontamination

Equipment used to excavate or handle contaminated Site soils or water will be decontaminated. The decontamination of the equipment will be performed by scrubbing with a detergent/potable-water solution. At the completion of site work, equipment will be decontaminated prior to leaving the Site. Rinse water will be allowed to evaporate from the decontamination area, to the extent possible.

9.0 EMERGENCY RESPONSE/CONTINGENCY PLAN

The required elements of an emergency response plan as specified in 29 CFR 1910.120(1) are listed below. As described in the regulation, many of these items primarily pertain to emergency responses at uncontrolled hazardous waste sites, and thus are not entirely applicable to the anticipated site activities, which do not constitute an emergency response situation. The contractor will be responsible for providing an emergency response plan for their activities. An explanation of how each plan element will be implemented at the Site is provided below:

1) Pre-emergency planning - This emergency response plan will be provided to all personnel, including subcontractor personnel, working on the Site during the pre-entry briefing. In addition, emergency response actions will be reviewed with all personnel during the pre-entry briefing and the tailgate safety meetings.

2) Personnel roles, lines of authority, and communication - The FS/HSO will be responsible for emergency coordination at all times. Any accidents and/or injuries shall immediately be reported to him. The FS/HSO will report any accidents to the PM and Corporate Health and Safety Director within 24 hours.

3) Emergency recognition and prevention - Physical and chemical hazards at the Site will be reviewed at the pre-entry briefing and the tailgate safety meetings.

4) Safe distances and places of refuge - Should emergency conditions arise requiring Site evacuation, the FS/HSO will notify all on-site personnel immediately through the use of hand signals and verbal instructions.

5) Site security and control - Site security will be provided by a chain-link fence on the Site perimeter with a gate.

6) Evacuation routes and procedures - The FS/HSO will notify all on-site personnel of the need for immediate evacuation. Site evacuation will be performed in an orderly fashion under the direction of the FS/HSO.

7) Emergency decontamination procedures - In the event of a medical emergency, personnel decontamination prior to medical treatment may be omitted. Whenever possible, MFG personnel will accompany contaminated victims to the hospital to advise on matters involving decontamination. If on-site first aid is rendered and the victim does not require transport to the hospital, clothing and equipment decontamination as described in Section 8.0 will be performed after first aid measures have been performed.

8) Emergency medical treatment and first aid - Based on the severity of the injury/exposure, additional medical treatment will be obtained as described in paragraph 9 below.

9) Emergency alerting and response procedures - The procedures listed below will be used in the event of any Site emergency:

a) Remove any injured person(s) from immediate danger and administer first aid as needed.

b) If a serious injury or life-threatening conditions exists, dial 911 from the nearest phone so that appropriate response teams may be dispatched. The FS/HSO will carry a cell phone at all times, and the nearest phone is located at the Site. Directions to the hospital are presented in Figure 2.

c) Notify PM before resuming work.

10) Critique of response and follow-up - Following any Site emergency, the FS/HSO will prepare a written report for review by the PM, MFG Corporate Health and Safety Director and the client. In addition, any accidents or emergency incidents shall be reported to the relevant local, state and federal agencies by the PM. The report will include a summary of the emergency, a description of the conditions that led to the emergency, a review of the response actions implemented following the emergency and a discussion of steps that might have been taken to prevent a recurrence of the emergency.

11) PPE and emergency equipment - All personnel will be required to have complete Level D, and Modified Level D PPE ensembles available for use when onsite. In addition, the MFG PM will have available a first aid kit, a fire extinguisher and possibly a portable eyewash kit.

10.0 CONFINED SPACE ENTRY PROCEDURES

No confined space entry is anticipated during site activities.

11.0 SPILL CONTAINMENT PROGRAM

The contractor will be required to provide a spill containment plan. Potentially hazardous fluids that may be located on-site during the field activities are decontamination water stored in buckets. All containerized fluids will be clearly labeled as to their origin and date of generation. If a spill of containerized fluids occurs, the PPE level for response personnel will be modified Level D.

12.0 HAZARD COMMUNICATION

The Hazard Communication Act (29 CFR 1910.1200), commonly referred to as the "Worker Right to Know Act", was instituted by the Occupational Safety and Health Administration (OSHA) to reduce illness and injury caused by chemical exposure in the workplace. The Act is implemented by informing employees of potential exposure.

12.1 Material Safety Data Sheets

MFG will inform its employees and subcontractors of potential hazards associated with chemicals brought to the Site to perform various field activities. The information will be distributed in the form of Material Safety Data Sheets (MSDSs). Copies of the MSDS for each chemical brought to the Site will remain onsite during the period that the chemical is being utilized. Safe handling practices and emergency first aid for each chemical will be discussed during the pre-entry briefing, tailgate safety meetings, etc. MSDS for contaminants of concern at the Site are included in Attachment D. Laboratory preservative MSDS's will be maintained in MFG's Field Notebook.

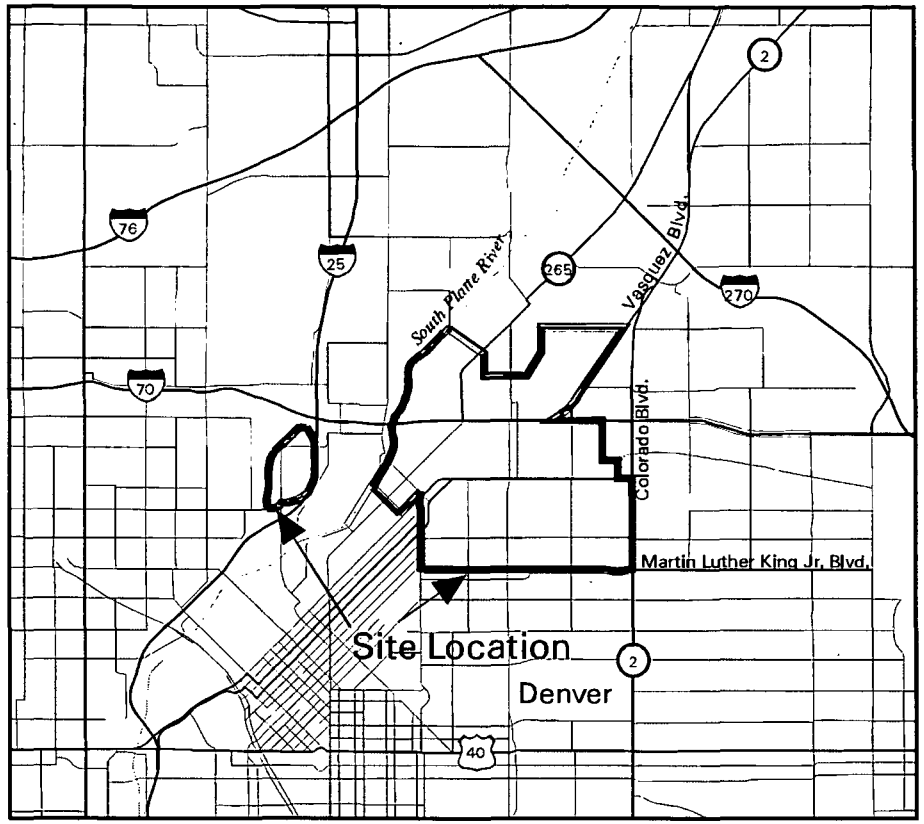
13.0 REFERENCES

MFG, Inc. 2002. *Corporate Health and Safety Program.*

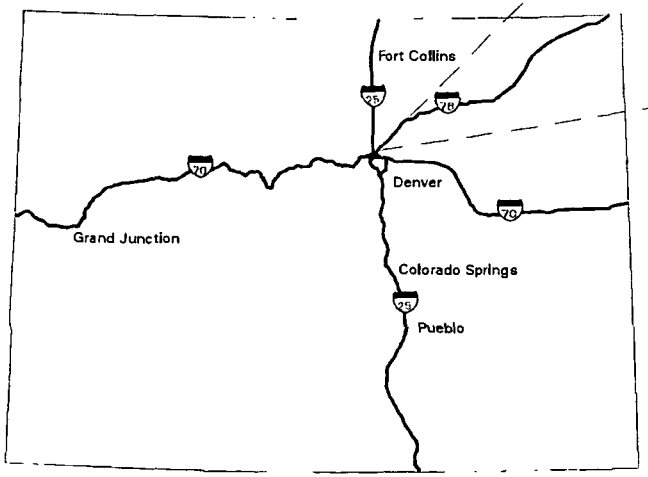
U.S. Department of Health and Human Services (NIOSH), 1999. *NIOSH Pocket Guide to Chemical Hazards: DHHS (NIOSH) Publication No. 99-140.* June 1999.

ASTDR Website. http//:www.astdr.gov

FIGURES



VB/I70 OU1 VICINITY



COLORADO

N

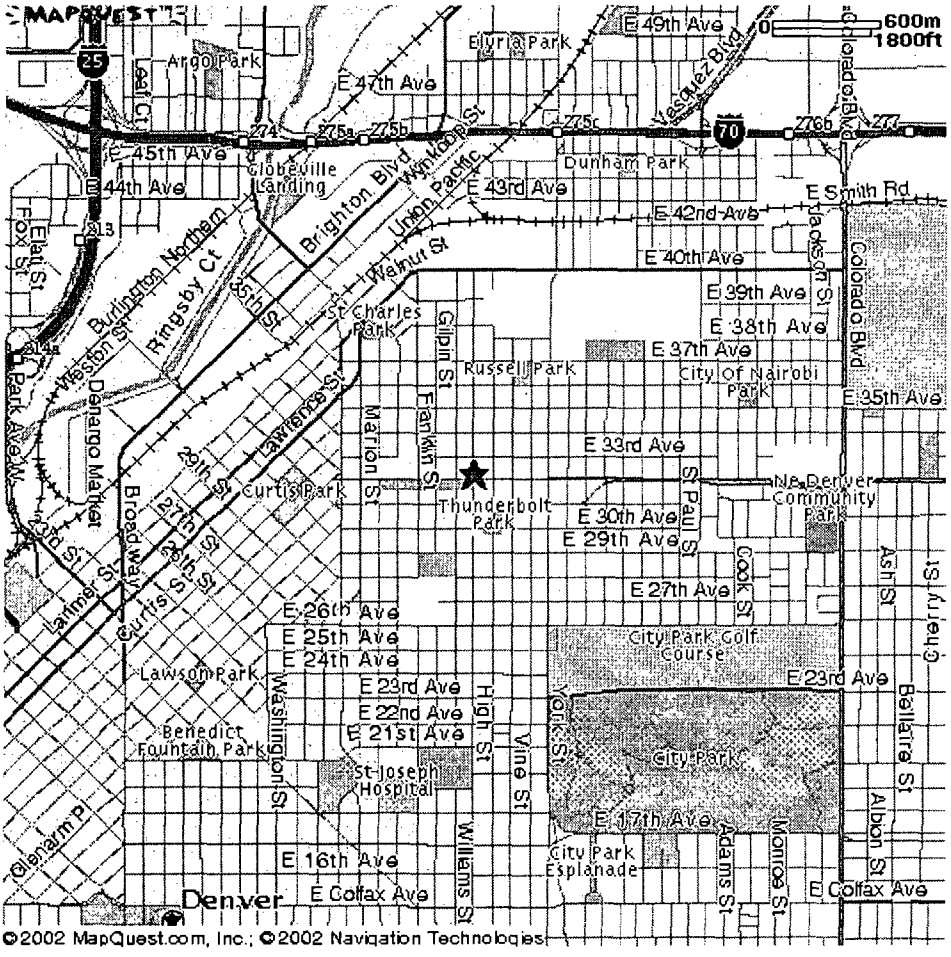
U.S. EPA REGION 8
VASQUEZ BOULEVARD/
INTERSTATE 70 SITE OPERABLE UNIT 1

Figure 1 - 1

Site Location Map

PROJECT: 01- 0107x- 1	DATE: JULY 31, 2002	
REV: 0	BY: ALB	CHECKED:

Figure 2
Location of Nearest Hospital:
Denver Health
3216 High Street



TABLES

TABLE 1
REQUIREMENTS FOR EQUIPMENT OPERATION NEAR POWER LINES
(29 CFR 1926.550)

ACTIVITY	LINE RATING	MINIMUM CLEARANCE
Equipment Operation	≤50 kV	10 feet
	> 50 kV	10 feet + 0.4 inches per each kV over 50kV, or 2 times the length of the line insulator (minimum of 10 feet)
In transit with no load and beam lowered	≤50 kV	4 feet
	> 50 kV to ≤ 345 kV	10 feet
	345 kV to ≤ 750 kV	16 feet

Note: kV = kiloVolt

TABLE 2
OCCUPATIONAL GUIDELINES FOR SITE CONTAMINANTS OF CONCERN

CHEMICALS	Lead	Arsenic	REFERENCE
PEL	0.050 mg/m^3	none	OSHA (1999)
TLV-TWA	0.100 mg/m^3	0.5 mg/m^3	NIOSH (1997)
TLV-STEL	Not Determined	Not Determined	NIOSH (1997)
IDLH	100 mg/m^3 (as Pb)	Not Determined	NIOSH (1997)

TABLE 3: NON-CHEMICAL HAZARDS

TASK/HAZARD	NON-CHEMICAL HAZARD DESCRIPTION
Working in Protective Gear	Possible heat exposure, heat stress, dehydration, or sunstroke. Symptoms include heat rash, heat cramps, heat exhaustion, dizziness, nausea, faintness, and elevated body temperature. Personnel exhibiting symptoms of heat stress must stop work immediately and go and sit in the shade and rest for at least 15 minutes, and drink cool fluids or water.
Sunburn	Over-exposure to the sun can be prevented. Personnel will bring sunscreen with an SPF of least 30 with them to the field and apply it several times a day.
Inclement Weather	Cold exposure and hypothermia can result during wet or cold weather conditions. Symptoms of hypothermia include numb body parts (fingers, toes, ears, nose), uncontrollable shaking, slurred speech, impaired judgment and poor coordination. Personnel with any cold exposure symptoms must stop work immediately and get warmed.
Drowning	Field sampling activities along surface waters pose a potential drowning hazard. This hazard is addressed in US Coast Guard Regulation 29 CFR 1926.106: "Employees working over or near water, where the danger of drowning exists, shall be provided with U.S. Coast Guard-approved life jackets or buoyant work vests." Workers working over or in water greater than 3 feet deep will be required to don a life vest. Workers working near water (i.e., along the shore) will not be required to wear life vests; however, life vests will be available within 50 feet of the work activity. A rescue line must also be available.
Stream Work	Sampling activities may take place in or adjacent to streams and rivers. Hazards include slips, trips and falls resulting from underestimating the power of currents, stepping on slippery or potentially unstable rocks or logs, or slipping on steep banks and drop offs. Drowning could result from unconsciousness after a fall, being swept away by currents, becoming trapped under obstacles in deep, rapidly moving water, being pulled under if waders fill with water, or an inability to swim.
Poisonous Plants	Poisonous plants, such as poison ivy, may be present on site. Reactions to poisonous plant exposure vary depending on the individual and the severity of the exposure, and can range from minor skin irritation to severe allergic reactions (oozing rashes and swelling) that require medical attention. Skin protection such as Ivy Block is available in the field kit.
Biting/Stinging Insects	Wasps, bees, spiders, centipedes and other insects may be found on site. Wear insect repellent. Bites and stings from insects may be painful but generally are not dangerous, unless the individual bitten/stung is severely allergic. Some spiders such as the Black Widow and Brown Recluse can inflict a serious bite that should be evaluated by a medical professional.
Ticks	Ticks are small (2mm to 7mm), blood-eating parasites related to spiders that may reside in brushy or grassy areas. When an animal or person passes, the tick will jump onto the passing host and crawl around looking for a place to attach itself and begin feeding. Tick bites can result in transmission of Lyme Disease, Rocky Mountain Spotted Tick Fever and other diseases, and may become infected. Lyme Disease can be a debilitating, long-term illness. All tick bites must be evaluated by a medical professional.
Small Animals	Never approach animals, including dogs and cats. Many serious diseases can be transmitted from animals such as rabies, Hantivirus and Cat Scratch Fever. All animal bites must be evaluated by a medical professional.
Snakes	Snake bites can occur when snakes are inadvertently disturbed when stepping on or near them, or placing hands in crevices. Never handle a snake. Assume all snakes are poisonous. All snake bites must be immediately evaluated by a medical professional.
Working Hours	Normal working hours in the field are from 7am to 5pm. Personnel needing to work outside these normal working hours must first get permission from the Project Manager. Tasks involving extended work hours (i.e., after 5 pm) require the buddy system – at least 2 people must be present for nighttime work. Personnel may not work alone after dark.

ATTACHMENT A

SAFETY COMPLIANCE AGREEMENT FORMS

SAFETY COMPLIANCE AGREEMENT FORM

MFG, Inc.
Personnel Form

PROJECT NO.:	010107x-7
PROJECT TITLE:	Vasquez Boulevard and I-70 Superfund Site
PROJECT TASK:	Pilot Study

I have received a copy of the Site Health and Safety Plan (the "HASP") for the above referenced project. I have read the HASP and agree to comply with all the health and safety requirements contained therein. I understand that I may be prohibited from working on the project for violating any of the HASP requirements.

PRINT NAME:_____

SIGNATURE: _____ DATE: _____

NOTE: This form must be submitted to the Project Manager prior to beginning field activities.

SAFETY COMPLIANCE AGREEMENT FORM

MFG, Inc.
Subcontractor Form

PROJECT NO.:	010107x-7
PROJECT TITLE:	Vasquez Boulevard and I-70 Superfund Site
PROJECT TASK:	Pilot study

The MFG Site Health and Safety Plan (the "HASP") provides guidance for site-specific safety requirements. It is not intended to replace any general or specific requirements of a contractor's safety program. MFG personnel will, to the best of their ability, inform contractors of any potential hazard(s) that has been identified during the field investigations. However, contractors will bear the ultimate responsibility for all matters dealing with health and safety in the performance of their appointed work. This responsibility will include, at a minimum, ensuring that their equipment is in proper working order and that their employee' s and/or authorized representatives are trained and medically fit in accordance with OSHA Standards 29 CFR 1910 and 29 CFR 1926, as appropriate. The contractor is also responsible for informing its' subcontractors of these requirements.

I have received a copy of the HASP for the above referenced project. I have read the HASP and agree to comply with all the health and safety requirements contained therein. I understand that I may be prohibited from working on the project for violating any of the HASP requirements.

PRINT NAME:_____

SIGNATURE: _____ DATE: _____

AFFILIATION: _____

NOTE: This form must be submitted to the Project Manager prior to beginning field activities.

ATTACHMENT B

HASP ADDENDA

THIS SECTION IS INTENDED TO BE BLANK AND IS RESERVED FOR ADDITIONAL ADDENDA TO THIS HASP

ATTACHMENT C

DAILY SAFETY MEETING ATTENDANCE FORM

DAILY SAFETY MEETING ATTENDANCE FORM

MFG, Inc.

Project Name: _____ Date: _____ Time: _____

Project Number: _____ Presented by: _____

Signature: _____

Check the Topics/Information Reviewed:

- ☐ safety glasses, hard hat, safety boots
- ☐ site safety plan review and location
- ☐ equipment and machinery familiarization
- ☐ employee Right-To-Know/MSDS location
- ☐ open pits, excavations, and site hazards
- ☐ vehicle safety and driving/road conditions
- ☐ portable tool safety and awareness
- ☐ overhead utility locations and clearance
- ☐ first aid, safety, and PPE location
- ☐ sharp object, rebar, and scrap metal hazards
- ☐ safety is everyone's responsibility
- ☐ inner gloves/outer gloves
- ☐ excavation/trenching inspections/documentation
- ☐ full face respirators with proper cartridges
- ☐ location and operation of kill switch
- ☐ slips, trips, and falls
- ☐ directions to hospital/first aid
- ☐ anticipated visitors
- ☐ electrical ground fault
- ☐ public safety and fences
- ☐ excavator swing and loading
- ☐ orderly site and housekeeping
- ☐ smoking in designated areas
- ☐ leather gloves for protection
- ☐ effects of the night before
- ☐ vibration related injuries
- ☐ fire extinguisher locations
- ☐ eye wash station locations
- ☐ decontamination procedures
- ☐ daily work scope
- ☐ emergency protocol
- ☐ parking and lay down
- ☐ hot work permits
- ☐ strains and sprains
- ☐ noise hazards
- ☐ no horseplay
- ☐ heat and cold stress
- ☐ backing up hazards
- ☐ accidents are costly
- ☐ dust and vapor control
- ☐ refueling procedures
- ☐ confined space entry
- ☐ Safety is No Accident

☐ upgrade to level C at: PID (___ eV) >___ ppm

☐ work stoppage at: PID (___ eV) >___ ppm, % LEL > 10%

Discussion/Comments/Follow-up Actions: _____

_____

_____

NAME	SIGNATURE	COMPANY

Instructions:

- Conduct a daily safety meeting prior to beginning each day's site activities.
- Complete form, obtain signatures, and file with the Daily Summary.
- Follow-up on any noted items and document resolution of any action items.

ATTACHMENT D

MATERIAL SAFETY DATA SHEETS

LEAD

International Chemical Safety Card

ICSC: 0052

1.1.1.1.1.1 LEAD

LEAD
Lead metal
Plumbum
(powder)
Pb
Atomic mass: 207.2
CAS # 7439-92-1
RTECS # OF7525000
ICSC # 0052

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Finely divided lead powder is flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking (if in powder form).	In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN! AVOID EXPOSURE OF ADOLESCENTS AND CHILDREN!	IN ALL CASES CONSULT A DOCTOR!
INHALATION	Abdominal cramps. Drowsiness. Headache. Nausea. Vomiting. Weakness. Wheezing. Pallor. Hemoglobinuria. Collapse.	Ventilation (not if powder). Avoid inhalation of fine dust and mist. Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
SKIN			
EYES			
INGESTION	Abdominal cramps (further see Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully	Separated from strong oxidants, strong bases, strong acids, food and feedstuffs.	

collect remainder, then remove to safe place. Do NOT let this chemical enter the environment (extra personal protection: P2 filter respirator for harmful particles).		
SEE IMPORTANT INFORMATION ON BACK		
ICSC: 0052	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993	

LEAD

ICSC: 0052

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** BLUISH-WHITE OR SILVERY-GREY SOLID IN VARIOUS FORMS. TURNS TARNISHED ON EXPOSURE TO AIR. **PHYSICAL DANGERS:** Dust explosion possible if in powder or granular form, mixed with air. **CHEMICAL DANGERS:** Upon heating, toxic fumes are formed. Reacts with hot concentrated nitric acid, boiling concentrated hydrochloric and sulfuric acids. Attacked by pure water and by weak organic acids in the presence of oxygen. **OCCUPATIONAL EXPOSURE LIMITS (OELs):** TLV: ppm; 0.15 mg/m^3 (as TWA) (ACGIH 1993-1994).	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol and by ingestion. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly. **EFFECTS OF SHORT-TERM EXPOSURE:** The substance may cause effects on the gastrointestinal tract, blood, central nervous system and kidneys , resulting in colic, shock, anemia, kidney damage and encephalopathy. Exposure may result in death. The effects may be delayed. Medical observation is indicated. **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** The substance may have effects on the gastrointestinal tract, nervous system, blood, kidneys and immune system , resulting in severe lead colic, paralysis of muscle groups of the upper extremities (forearm, wrist and fingers), anemia, mood and personality changes, retarded mental development, and irreversible nephropathy. May cause retarded development of the newborn. Danger of cumulative effect.
PHYSICAL PROPERTIES	Boiling point: 1740°C Melting point: 327.5°C	Relative density (water = 1): 11.34 Solubility in water: none
ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to air and water. In the food chain important to humans, bioaccumulation takes place, specifically in plants and water organisms, especially shellfish.	

NOTES

Explosive limits are unknown in literature. Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure, periodic medical examination is indicated. Do NOT take working clothes home. Refer also to cards for specific lead compounds, e.g., lead chromate (ICSC # 0003), lead(II) oxide (ICSC # 0288).

Transport Emergency Card: TEC (R)-61G12b

ARSENIC

ARSENIC	ICSC: 0013

Date of peer-review: October 1999

Grey arsenic

CAS #	7440-38-2	As
RTECS #	CG0525000	Atomic mass: 74.9
UN #	1558	
EC #	033-001-00-X	

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames. NO contact with strong oxidizers. NO contact with hot surfaces.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Risk of fire and explosion is slight when exposed to hot surfaces or flames in the form of fine powder or dust.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		**PREVENT DISPERSION OF DUST! AVOID ALL CONTACT! AVOID EXPOSURE OF (PREGNANT) WOMEN!**	**IN ALL CASES CONSULT A DOCTOR!**
Inhalation	Cough. Sore throat. Shortness of breath. Weakness. (See Ingestion).	Closed system and ventilation.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
Skin	Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
Eyes	Redness.	Face shield, or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Abdominal pain. Diarrhea. Nausea. Vomiting. Burning sensation in the throat and chest. Shock or collapse. Unconsciousness.	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Evacuate danger area! Sweep spilled substance into sealable containers. Carefully collect remainder, then remove to safe place. Chemical protection suit including self-contained breathing apparatus. Do NOT let this chemical enter the environment.	Do not transport with food and feedstuffs. Marine pollutant. **EU Classification** Symbol: T R: 23/25 S: (1/2-)20/21-28-45

	UN Classification UN Hazard Class: 6.1 UN Pack Group: II
EMERGENCY RESPONSE	**STORAGE**
Transport Emergency Card: TEC (R)-61G64b	Separated from strong oxidants, acids, halogens, food and feedstuffs. Well closed.

IPCS
International Programme on Chemical Safety

UNEP

SEE IMPORTANT INFORMATION ON BACK

ARSENIC	**ICSC: 0013**

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
ODOURLESS, BRITTLE, GREY, METALLIC-LOOKING CRYSTALS.

CHEMICAL DANGERS:
Upon heating, toxic fumes are formed. Reacts violently with strong oxidants and halogens, causing fire and explosion hazard. Reacts with acids to produce toxic arsine gas (see: ICSC # 0222).

OCCUPATIONAL EXPOSURE LIMITS:
TLV: ppm; 0.01 mg/m^3 (as TWA) A1 (ACGIH 1999).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation of its aerosol and by ingestion.

INHALATION RISK:
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly, when dispersed.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance irritates the eyes, the skin and the respiratory tract. The substance may cause effects on the gastrointestinal tract, cardiovascular system, central nervous system and kidneys, resulting in severe gastroenteritis, loss of fluid, and electrolytes, cardiac disorders, shock, convulsions and kidney impairment. Exposure above OEL may result in death. The effects may be delayed. Medical observation is indicated.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
Repeated or prolonged contact with skin may cause dermatitis. Repeated or prolonged contact may cause skin sensitization. The substance may have effects on the mucous membranes, skin, peripheral nervous system, liver and bone marrow, resulting in pigmentation disorders, hyperkeratosis, perforation of nasal septum, neuropathy, liver impairment, anemia. This substance is carcinogenic to humans. Animal tests show that this substance possibly

	causes malformations in human babies.
PHYSICAL PROPERTIES	
Sublimation point: 613°C Density: 5.7 g/cm^3 Solubility in water: none	
ENVIRONMENTAL DATA	
The substance is toxic to aquatic organisms. It is strongly advised not to let the chemical enter into the environment because it persists in the environment.	
NOTES	
The substance is combustible but no flash point is available in literature. Depending on the degree of exposure, periodic medical examination is indicated. Do NOT take working clothes home. Refer also to cards for specific arsenic compounds, e.g., Arsenic pentoxide (ICSC # 0377), Arsenic trichloride (ICSC # 0221), Arsenic trioxide (ICSC # 0378), Arsine (ICSC # 0222).	
ADDITIONAL INFORMATION	
LEGAL NOTICE	Neither the CEC nor the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information

ATTACHMENT E

MFG PERSONAL PROTECTIVE EQUIPMENT PROGRAM

E-1	**Levels of Protection**
E-2	**Outline for Selecting Respiratory Protective Devices**
E-3	**Respirator Fit Test Record**

MFG PERSONAL PROTECTIVE EQUIPMENT PROGRAM

MFG has developed and implemented a personal protective equipment (PPE) program to comply with the requirements of 29 CFR 1910.120 (g)(5). This PPE program contains procedures for:

1. PPE use and limitations;
2. PPE maintenance and storage;
3. PPE decontamination and disposal;
4. PPE training and proper fitting;
5. PPE donning and doffing;
6. PPE inspection prior to, during, and after use;
7. Evaluation of the PPE program effectiveness; and
8. Limitations during temperature extremes and heat stress, and other appropriate medical considerations.

The PPE program also includes a respiratory protection program (RPP) to comply with 29 CFR 1910.134.

The purpose of PPE is to shield individuals from safety and/or health hazards that may be encountered while performing site work. Careful selection, training, use and maintenance of PPE is necessary to minimize the risk to individuals while they are performing work in potentially hazardous environments. The type of PPE to be worn by MFG employees will be evaluated by the degree of exposure to a potential hazard on a site-to-site basis.

The minimum PPE to be worn by MFG employees at most sites will consist of head, eye, foot and, in some cases, hearing protection. On sites where there is a potential for exposure to specific physical hazards or to health hazards other than physical hazards, MFG employees may be required to wear protective clothing and/or respiratory protective devices. The MFG Site Safety Officer will be responsible for determining when conditions warrant upgrading or downgrading the level of protection. The Site Health and Safety Plan will also outline PPE decontamination and disposal procedures, PPE donning and doffing procedures, limitations during temperature extremes and heat stress, etc.

Training in the proper use and limitation, maintenance and storage, fitting, donning and doffing, etc., of PPE will be initially received by employees in an OSHA off-site hazardous materials health and safety course (i.e., 40-hr course). At a minimum, these skills will be maintained by attendance of annual refresher courses. Supplemental training may be provided by qualified MFG personnel, outside contractors, vendors, etc., on an as needed basis. It is the employee's responsibility to read and become familiar with the manufacturer's instructions concerning, but not limited to, the use, limitation, care, storage, etc., of all PPE.

The PPE program will typically be evaluated on an annual basis. Training and/or literature obtained by MFG personnel will be used to revise and update the procedures, provisions, etc., presented in the following sections. In addition, information, experience, etc., obtained during projects, or knowledge of new techniques, may be used to revise the PPE program at any time.

The following sections briefly describe the use of head, eye, foot, hearing, and respiratory protective equipment. In addition, the use of chemically-resistant clothing is also addressed. Infrequently, an employee may be required to use PPE not addressed in these sections for a specific project-related task. On such occasions, the procedures for the use and limitation, maintenance and storage, decontamination and disposal, training and proper fitting, donning and doffing, inspection, evaluation of effectiveness, and medical considerations will be contained in the Site Health and Safety Plan.

E-1.0 Head Protection

The use of helmets (hard hats) for the protection of heads from impact and penetration from falling and flying objects is specified under 29 CFR 1910.135. In general, MFG employees will be required to wear hard hats when the potential exists for a threat from an overhead object. In many cases, mandatory use of hard hats is required by clients while performing work at any location on their facility.

As specified in 29 CFR 1910.135, MFG will supply employees with head protection that meets the requirements of the American National Standards Institute (ANSI) Standard Z89.1 Requirements for Industrial Head Protection.

The hard hats will be used, cleaned, maintained, etc., by the employee per the manufacturer's instructions. Employees will inspect hard hats prior to each use to ensure that the hat is in proper condition. Use of head protection with structural damage, or alterations that may compromise the

structural integrity of the hard hat, is prohibited. If defects are detected, the hat will be exchanged. Any alterations to the hat such as, but not limited to, drilling of holes, painting, or cleaning with solvents and/or thinners, or modifications to the suspension can compromise the structural integrity of the hat.

E-2.0 Eye and Face Protection

The use of protective eye and/or face equipment is specified under 29 CFR 1910.133. MFG employees will be required to wear eye protection on all job sites. The type of protection required will be a function of the potential threat and will be specified in the Site Health and Safety Plan. In general, safety glasses with permanently attached side shields will be required when the principal threat is physical (e.g., flying objects). When the potential for splash exists, goggles or face shields may be required.

MFG will supply employees with safety glasses, goggles, and/or face shields that meet the requirements of ANSI Standard Z87.1 Occupational and Educational Eye and Face Protection. For employees who require the use of corrective lenses, MFG will reimburse those individuals for the purchase of one pair of glasses that comply with the above ANSI Standard. The eye glasses must have permanently attached side shields.

Face and eye protection will be used, cleaned, maintained, etc., by the employee per the manufacturer's instructions. Employees will inspect eye and/or face protection prior to each use to ensure that it is in proper condition. Use of eye and face protective equipment with structural or optical defects is prohibited. If defects are detected, the eye or face protection will be exchanged.

E-3.0 Foot Protection

The use of foot protection (i.e., steel-toe boots) is specified under 29 CFR 1910.136. MFG employees will be required to wear foot protection on all job sites. The construction of the foot protection (e.g., leather, PVC, etc.) will be a function of the potential threat and will be specified in the Site Health and Safety Plan.

MFG will reimburse employees for the purchase of one pair of leather boots and one pair of waterproof (e.g., PVC) boots. On projects that necessitate the purchase of footwear composed of specific chemical resistant materials, MFG will supply personnel with the appropriate footwear.

Employees are responsible for ascertaining that the footwear they purchase complies with the requirements of the ANSI Standard Z41.1 Men's Safety-Toe Footwear. The footwear will be used, cleaned, maintained, etc., by the employee per the manufacturer's instructions. Employees will inspect foot protection prior to each use to ensure that it is in proper condition. Use of footwear with structural defects, worn soles, cracks, etc., is prohibited. If defects are detected, the boots will be exchanged.

E-4.0 Hearing Protection

Exposure to high noise levels can cause hearing loss or impairment. There is no cure for noise-induced hearing loss, so the prevention of excessive noise exposure is the only way to avoid hearing damage. Protection against the effects of occupational noise exposure is specified in 29 CFR 1910.95. This OSHA standard sets an 8-hour time-weighted-average (TWA) sound exposure level of 90 decibels (dBA); the 8-hour TWA action level is set at 85 dBA.

MFG does not routinely monitor noise levels at job sites. However, it is MFG's policy that hearing protection be used whenever the potential exists for exposure to excessive noise levels. As such, it is the responsibility of the employee to use company-supplied hearing protection whenever project work is performed adjacent to any operating machinery, etc., or the project involves the use of any equipment, tools, etc., no matter how long the duration. The following data, extracted from "*Fundamentals of Industrial Hygiene*"[1] (Table 9-B), are provided as examples of noise levels generated by common activities/equipment: average residence - 40 dBA; noisy office - 80 dBA; passing truck - 100 dBA; and turbo jet engine - 150 dBA.

Disposable earplugs will be used one time, per the manufacturer's instruction, and then discarded. Non-disposable hearing protection will be used, cleaned, maintained, etc., by the employee per the manufacturer's instructions. Employees will inspect hearing protection prior to each use to ensure that it is in proper condition. Use of hearing protection with structural or acoustical damage is prohibited. If defects are detected, the hearing protection will be exchanged.

E-5.0 Chemically Resistant Clothing

Protective clothing prevents potentially dangerous chemicals from entering the body, usually through the skin. Such clothing also protects the body from burns and cold or wet conditions. Protective

[1] National Safety Council, 1988, page 168.

clothing can range from gloves to fully encapsulated suits. The chief characteristics of chemical protective clothing include:

1. Strength;
2. Flexibility;
3. Thermal limits; and
4. Chemical resistance.

Strength depends on the material's tensile strength and its resistance to abrasions, punctures, and tears. Flexibility allows the individual to move and work effectively. Gloves especially must be flexible, and in cold weather this is sometimes a problem. Thermal limits refer to the material's ability to maintain its protective capacity in temperature extremes. Thermal limits also affect worker mobility in cold weather and heat transfer in hot weather.

Chemical resistance refers to a material's ability to retain its structural integrity and protective qualities. Material can degrade when a contaminant or chemical reacts with the material. All material eventually degrades. Swelling, shrinking, brittleness, softness, discoloration, elongation or cracking indicates deterioration. These conditions should alert the worker to the possibility that the material is not providing adequate protection.

Chemical resistance can also be described in terms of:

1. Degradation;
2. Breakthrough time;
3. Penetration; and
4. Permeation.

Degradation is the change of the material's physical properties as a result of the chemical's negative effects. Breakthrough time is the time it takes the chemical to pass through the protective material until it is first detected by an analytical instrument. Penetration refers to bulk chemical flow through the protective material. Penetration is not a material property but rather a function of garment design and construction.

Penetration can occur through:

1. Material defects;
2. Seams;
3. Sleeves;
4. Pant legs;

5. Zippers, button holes or other enclosures;
6. Neck or head openings; and
7. Porous material.

Aerosol particulates, mists, gas, and vapors have the greatest penetration ability. Penetration can be prevented by:

1. Stitched and lapped or sealed areas;
2 Self-sealing zipper and overlap flap;
3. Hood with elastic sealed connection;
4. Elastic wrists and ankles;
5. One-piece suit; and
6. Taping seams and openings such as ankles, wrists, and zippers.

The significance of penetration depends on skin absorptivity and the following contaminant characteristics:

1. Toxicity;
2. Concentration;
3. Physical phase; and
4. Exposure route.

Use of a garment constructed of an impenetrable material can cause the possibility of heat stress because outside air is not allowed to penetrate the material; thus, little air moves within the garment. Cooling devices (e.g., ice vests) are not always effective or efficient.

Permeation (i.e., chemical movement at the molecular level through the material) occurs once the chemical has broken through the material. Because movement is by molecular diffusion, movement is microscopic and unnoticeable by the unaided eye. The contaminant, which can condense inside the material, will tend to reach an equilibrium concentration gradient.

Permeation rate, the rate of chemical movement through the material once breakthrough has started, can be very fast or very slow. Permeation rate is:

1. Inversely proportional to material thickness (discounting fillers);
2. Directly proportional to contaminant concentration gradient; and
3. Directly proportional to the amount of direct contact with the contaminant.

Chemical resistance of the protective materials is based on laboratory degradation or permeation tests. Laboratories perform these tests at room temperature; higher temperatures may decrease permeation time and rate. These data are approximate values because manufacturers' products, even products made of the same material, can have different properties. In addition, considerations should be given to the following facts:

- Eventually all chemicals pass or permeate through protective materials, and this can happen without any visible indications;
- A material may protect a worker well against one chemical but poorly against another; no single material is an absolute barrier against all chemicals;
- Garments that look alike do not necessarily possess identical protective qualities; and
- When a material starts to absorb a chemical, the chemical will continue to permeate through the material even though the material may not be in direct contact with the chemical.

Specific considerations for glove, suit and boot selection include the following:

Hands will probably come in contact with the greatest variety of contaminants;

Gloves generally need to withstand longer exposure times;

Gloves need to be flexible because intricate work is usually done with the hands;

Inexpensive disposable suits can be worn over fully encapsulated suits to reduce contamination of the underlying suit;

Garments that workers do not dispose of must be decontaminated;

Boots must withstand long exposure times; especially if workers must stand in liquid; and

Physical and psychological stress caused by the garment, especially the fully encapsulated suits, which can cause the wearer claustrophobia.

Chemical protective clothing will be required whenever the potential exists for exposure to hazardous concentrations of aqueous, solid, particulate and/or gaseous contaminants. In many instances, chemically protective clothing will be used in conjunction with respiratory protective devices. Used together, combinations of these PPE will offer different levels of protection (i.e., Levels A, B, C, and D). The appropriate level of protection selected will be a function of the potential concentrations of the contaminant(s), the forms in which they are present, the route(s) of potential exposure (i.e., inhalation, skin absorption, ingestion, eye or skin contact, etc.), and the employee's work requirements and task-specific conditions.

The Site Health and Safety Plan will outline the levels of protection required of each individual for each task to be performed. The levels of protection will be assessed using site-specific chemical and physical data. The selection of PPE will be performed using guidelines in documents such as "Personal Protective Equipment for Hazardous Materials Incidents: A Selection Guide"2 and "Guidelines for the Selection of Chemical Protective Clothing"3. The MFG Site Safety Officer will be responsible for determining when conditions warrant upgrading or downgrading the level of protection. This determination will be made on the basis of "action levels" established in the Site Health and Safety Plan.

The Site Health and Safety Plan will also outline decontamination and disposal procedures, donning and doffing procedures, etc., for chemically protective clothing. Employees will inspect protective clothing prior to use to ensure that it is in proper condition. Use of protective clothing with structural defects is prohibited. If defects are detected, the protective clothing will be exchanged. In general, gloves, outer boots, and disposable coveralls will be replaced daily. If they become damaged, they will be replaced immediately.

E-6.0 Respiratory Protection

The use of respiratory protection is specified under 29 CFR 1910.134. The primary objective of this protection is to limit employee exposure to harmful atmospheric conditions. Potential exposure will be initially limited by engineering control measures, to the extent practical. When effective engineering controls are not feasible or effective, appropriate respiratory protection will be used.

MFG has developed the following Respiratory Protection Program (RPP) to comply with 29 CFR 1910.134(a)(2). It is the responsibility of the employee to use the provided respiratory protection in accordance with the instructions and training provided by the manufacturer, OSHA training courses, Site Health and Safety Plans, etc. The majority of this section is oriented to the selection, use, maintenance, etc. of air-purifying respirators (APRs), or Level C respiratory protection. Additional instruction, training, etc. for care and use of supplied air respiratory equipment (e.g., Levels A and B of respiratory protection) will be included in Site Health and Safety Plans, as appropriate.

E-6.1 Standard Operating Procedure for the Selection and Use of Respirators

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2 NIOSH, 1984

3 ACGIH, 1987, Third Edition.

The document *"NIOSH Respirator Decision Logic"*[4], or equivalent, will be used as guidance for selecting appropriate levels of respiratory protection. Outside consultation, manufacturers' assistance, and other recognized authorities may be consulted if there is any doubt regarding proper selection and use.

E-6.2 Respirator Selection

Respirators will be selected on the basis of hazards to which the worker may be potentially exposed. All selections will be made using site-specific chemical and physical data. The selection process will be documented in the Site Health and Safety Plan.

E-6.3 Instruction and Training

Employees will be instructed and trained in the proper use of respirators and their limitations. Training will provide the employee an opportunity to handle the respirator, have it properly fitted, test its face piece to face seal, wear it in normal air for a long familiarity period, and finally wear it in a test atmosphere. Employees will receive fitting instructions, including demonstrations and practice in how the respirator should be worn, how to adjust it, and how to determine if it fits properly.

Training in the proper use and limitations, maintenance, and storage, fitting, donning, doffing, etc., of respirators will be initially received by employees in an OSHA off-site hazardous materials health and safety course. At a minimum, these skills will be maintained by attendance at an annual refresher course.

Respirators will not be worn when conditions prevent a good face seal. Such conditions may be growth of a beard, sideburns, a skull cap that projects under the face piece, or temple pieces on glasses. No employees who are required to wear respirators may wear beards. Also, the absence of one or both dentures can seriously affect the fit of a face piece. To assure proper protection, it is the employee's responsibility to check the face piece fit each time the employee puts on the respirator. This will be done by following the manufacturer's face piece-fitting instructions.

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[4] NIOSH, 1987; Publication No. 87-108

Employees who may be required to wear respirators will be qualitatively fit-tested on an annual basis. However, under certain work situations, it may be necessary to perform quantitative fit testing. Fit testing documentation will be maintained in the corporate files.

E-6.4 Cleaning, Disinfection, and Storage

Where practicable, respirators will be assigned to individual employees for their exclusive use. Employees will be responsible for regularly cleaning and disinfecting their respirators. Respirators issued for the exclusive use of one employee will be cleaned after each use, or more often, if necessary. Respirators used by more than one employee will be thoroughly cleaned and disinfected after each use. Respirators will be cleaned and disinfected per the manufacturer's instructions.

Employees must store their respirators to protect against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Protection against mechanical damage will also be the responsibility of the employee. Respirators will be stored so that the face piece and exhalation valve will rest in a normal position to prevent the rubber or plastic from reforming in an abnormal shape.

E-6.5 Inspection

Employees will be responsible for the routine inspection of their respirators. Respirators will be inspected for wear and deterioration of their components before and after each use. Special attention will be given to rubber or plastic parts. The face piece, especially the face seal surface, headband, valves, connecting tube, fittings, and canister connections must be in good condition. At a minimum, respirators will be inspected during the annual fit test procedure. If defects are detected, the respirator will be repaired/replaced. Inspection of the respirators will be documented. These inspection records will be maintained in the corporate files.

E-6.6 Surveillance

Appropriate surveillance of work area conditions (e.g., ambient air monitoring, personal monitoring, etc.) and degree of employee exposure or stress will be performed per the Site Health and Safety Plan.

E-6.7 Program Evaluation

Regular inspection and evaluation will be performed to assess the continued effectiveness of the RPP. The Corporate Health and Safety Director may make periodic inspections of employee respirators to ensure compliance with the cleaning, disinfection, storage, inspection requirements. In addition, the Site Safety Officer may make periodic audits of job sites to ensure compliance with the RPP. The evaluation records will be maintained in the corporate files.

E-6.8 Medical Monitoring

Employees will not be assigned to tasks requiring use of respirators unless it has been determined that they are physically able to perform the work and use the equipment. The respirator user's medical status will be reviewed annually.

E-6.9 Certification

Respirators will be MSHA- or NIOSH-approved. Supplied air will meet or exceed Grade D breathing air specifications. A small, backup SCBA (escape pack) will be carried by personnel when using an SCBA or air-line respirator.

ATTACHMENT E-1

Levels of Protection

LEVELS OF PROTECTION

Personal protective equipment is generally divided into four categories based on the level, or degree, of protection provided. The following are meant to serve as guidelines which can be used to select the appropriate level of protection; optional equipment is not included.

MODIFIED

LEVEL D A work uniform affording some skin protection; used mainly during sampling and decon.

Blue jeans, shirt with 4" sleeves.
Safety glasses or sunglasses.
Hearing protection.
Gloves: chemical resistant.
Boots: steel-toed.
Hard hat.

LEVEL D A work uniform affording minimal protection; used for nuisance contamination only.

Blue jeans, shirt with 4" sleeves.
Boots: steel-toed.
Hard hat.

ATTACHMENT E-2

Outline For Selecting Respiratory Protective Devices

ATTACHMENT E-3

Respirator Fit Test Record

RESPIRATOR FIT TEST RECORD

MFG, Inc.

A: EMPLOYEE: _____

SOCIAL SECURITY NO: _____

EMPLOYEE JOB TITLE: _____

B: RESPIRATOR TYPE: _____

MANUFACTURER: _____

MODEL: _____

SIZE: _____

C. CONDITIONS WHICH COULD AFFECT RESPIRATOR FIT:

BEARD	FACIAL SCAR
MOUSTACHE	GLASSES

COMMENTS: _____

D. FIT CHECKS:

NEGATIVE PRESSURE	PASS	FAIL	NOT DONE
POSITIVE PRESSURE	PASS	FAIL	NOT DONE

E. FIT TESTING:

QUANTITATIVE	ISOAMYL ACETATE QUALITATIVE	IRRITANT SMOKE QUALITATIVE
FIT FACTOR	PASS	PASS
	FAIL	FAIL

COMMENTS: _____

F. ACKNOWLEDGMENT

In accordance with the Corporate Respiratory Protection Program, I understand that I am responsible for:

Regular use of my respirator whenever there is a possibility I may be exposed to air contaminants;
Cleaning, disinfecting, inspecting and storing my respirator; and
Reporting respirator malfunction to my supervisor.

EMPLOYEE SIGNATURE: _____ DATE: _____

FIT TESTED BY: _____

SIGNATURE OF FIT TESTER: _____

ATTACHMENT F

MFG MEDICAL SURVEILLANCE PROGRAM

MFG MEDICAL SURVEILLANCE PROGRAM

F-1.0 Policy

All employees potentially exposed to occupational health hazards will participate in the medical monitoring program, with no exceptions.

F-2.0 Purpose

The medical monitoring program is designed to assess and monitor worker's health and fitness both prior to employment and during the course of work, to provide emergency and other treatment as needed, and to keep accurate records for future reference. MFG's medical program is designed to meet or exceed the OSHA requirements for workers that handle hazardous substances. The medical monitoring program provides for pre-placement, annual, periodic, post exposure and separation examinations for all MFG employees potentially exposed to occupational health hazards. MFG' s medical program is managed by WorkCare, Inc. of Orange, California. WorkCare specializes in providing oversight of medical surveillance programs. Their website address is: http://www.workcare.com.

F-3.0 Requirements

Site-specific medical monitoring programs will be developed based on specific needs, location, and potential exposures of employees at the site. This determination is made by Corporate Health and Safety Director, who is tasked with overall program management and quality control.

F-3.1 Pre-Placement Medical Examinations

The purpose of the pre-placement medical exam is twofold: (1) to determine the employee's fitness for duty, including the ability to work while wearing protective equipment; and (2) to provide baseline data for comparison with future medical data. A pre-placement medical examination is necessary prior to the employee initiating field work.

Termination physicals from previous employment may be accepted in lieu of MFG's pre-placement exam, within the constraints of exam content and time frame.

Pre-placement medical examinations may vary a great deal in content depending upon the nature of the job assignment. Pre-placement physicals for technical personnel may include the following components:

1. History and physical;
2. Vision - Titmus;
3. Audiogram;
4. Pulmonary Function Test (PFT);
5. Electrocardiogram (EKG);
6. Chest X-rays (with interpretation);
7. Blood Chemistry Panel;
8. Complete Blood Count (CBC);
9. Urinalysis with Microanalysis (UA);
10. Urine heavy metals (arsenic, cadmium, mercury) screen - optional;
11. Blood lead/ZPP - optional;
12. Tetanus booster - optional;
13. Respirator Clearance Form; and
14. Medical Clearance Form.

F-3.2 Annual Medical Exams

The annual physical exams will be equivalent to the pre-placement exam except for the history, which will include any relevant information concerning possible exposures, symptoms, etc. occurring since the last physical. More frequent examinations may be necessary, depending on the extent of potential or actual exposure, the type of chemicals involved, the duration of the work assignment, and the individual worker's profile. Additional tests for specific chemical exposures will be added to the annual exam when deemed appropriate by the physician.

F-3.3 Periodic Medical Exams and Supplemental Medical Monitoring

Periodic and supplemental medical monitoring examinations will be used in conjunction with pre-placement screening exams and annual physicals to compare sequential medical reports with baseline data; thus determining biological trends that may mark early signs of adverse health effects, and thereby facilitate appropriate protective measures. A baseline level for the site-specific compound of potential concern must be established prior to the employees beginning field work. The appropriate biological indicator and test method (e.g., blood analysis for lead, urine analysis for mercury) will be determined prior to initiating supplemental testing.

The frequency and content of examinations will vary, depending on the nature of the work and exposures. Periodic screening exams can include:

Interval medical history (focusing on changes in health status, illnesses, and possible work-related symptoms);

Review of the worker's interval exposure history, including exposure monitoring at the jobsite; and

Physical examination.

Additional site-specific supplemental monitoring and medical testing may include:

a. Pulmonary function test;

b. Audiometric tests;

b. Vision tests; and/or

d. Blood and urine tests for heavy metals or other compounds, when indicated.

F-3.4 Termination Medical Exams

A separation exam will be scheduled for employees who are participating in the medical surveillance program. The separation exam will be similar to the pre-placement exam, with the exceptions of the medical history (updated since the last physical), no chest x-rays will be taken and an EKG will not be given. The occupational physician will certify any deleterious effects arising from employment at MFG. Every effort will be made to encourage employees to complete a separation exam. If an employee refuses to take a separation exam, the "Exit Physical Waiver" form shall be completed by the employee at the time of separation.

F-3.5 Lead Examination

According to the OSHA lead standard (29 CFR 1910.1025), a medical surveillance program must be instituted and medical examinations and consultations must be made available to every employee potentially exposed above the lead action level (30 ug/m^3, averaged over an 8-hour period) for more than 30 days total per year, regardless of continuity of days. MFG shall assure that WorkCare, the physician and/or medical clinic maintains medical records for at least 40 years, or duration of employment plus 20 years, whichever is longer.

Prior to job commencement, a physician will evaluate and document the worker's baseline health status by collecting medical, environmental, and occupational histories; by performing a physical examination; and by requesting physiological and laboratory tests appropriate for the anticipated occupational risks.

The medical examination, both initial and periodic, will include the following:

A thorough physical examination that pays particular attention to the hematologic, gastrointestinal, renal, cardiovascular, and neurological systems;

An evaluation of pulmonary status to determine whether the worker is capable of wearing a respirator;

Blood pressure measurement;

A blood sample to determine blood lead levels, hemoglobin and hematocrit, blood urea nitrogen, serum creatinine, and zinc protoporphyrin (ZPP). Blood lead/ZPP tests will be repeated every 6 months, or more frequently if required by the HASP, for employees continuously assigned to lead-contaminated job sites;

A routine urinalysis with microscopic examination;

Pregnancy testing or male infertility testing, if requested by the worker; and

Any laboratory or other test that is recommended by the examining physician.

F-3.6 Employee Exposure Monitoring

Hazardous waste work involves potential exposure to a wide variety of potential hazards. In the case of chemical exposures and some physical hazards such as noise, these exposures may be measured and quantified. An employee will receive additional medical monitoring upon notifying the employer of symptoms consistent with overexposure to on-site chemicals, or if any employee is exposed to on-site chemicals at concentrations in excess of the permissible exposure limit (PEL) without protection.

Exposure monitoring may be accomplished for the purpose of establishing or verifying work area protection levels, to designate appropriate work zones, and to supplement or trigger medical monitoring requirements. This monitoring may be carried out by monitoring each individual's exposure or by conducting representative monitoring for specific work tasks or groups of employees exposed to similar hazards under similar conditions.

All exposure monitoring results will be communicated to the individual monitored or to the representative group of employees, as appropriate. Written monitoring reports will be provided to the employee and a copy will be maintained in the employee health and safety file. The results will also be provided to the physician who carries out the medical monitoring examinations for the Company and to WorkCare. Exposure monitoring records will be maintained for a period of 30 years, and may be stored on microfilm or microfiche, as necessary.

Employee exposure monitoring will be carried out in accordance with NIOSH standardized methods of sampling and analysis, or other equivalent methods. These

methods specify quality assurance/quality control (QA/QC) provisions for maintaining sampling and analytical integrity, precision, and accuracy. Samples will be analyzed by a laboratory accredited by the American Industrial Hygiene Association (AIHA).

F-3.7 Examining Physician's Report

The examining physician's written report will include the physician's opinion regarding the employee's ability to wear protective clothing and respiratory protective equipment. In addition, any medical condition that is detected via the examination process that is believed to be a direct result of the work environment will be included in this report. The examining physician's opinion regarding the individual's work restrictions will be documented in this report. The restrictions noted by the physician will be reviewed by MFG's Corporate Health and Safety Director. This information and decision will be summarized on a Fitness for Duty form.

The examining physician will be required to notify the employee of any conditions which are detected during the exam whether these conditions are deemed to be related to their work environment or not. In addition, the examining physician will provide the employee with a written copy of the examination and test results. These records may also be provided to the employee's personal physician upon written release by the employee.

F-4.0 Recordkeeping

An employee's medical records are considered personal and confidential and are kept separate from other personnel records. Records generated by the Medical Surveillance Program must be preserved and maintained by WorkCare, the physician and/or medical clinic for at least 30 years after termination of the employee' s employment with MFG. The original records are currently stored at each medical clinic and copies are maintained by WorkCare. The physician's written reports, x-rays, exam data, and test results make up the employee's confidential medical record. Project Managers will be made aware of medical information that is related to their employee's fitness for duty only.

F-4.1 Additional Information

All examining physicians will be provided copies of 29 CFR 1910.120, any pertinent employee exposure data available since the employee's last exam, the employee's job description, the employee's exposure levels or anticipated exposure levels, and a description of any PPE used or to be used. Each Office Health and Safety Coordinator is responsible for communicating this information to WorkCare and the examining physician.

PHYSICAL EXAMINATION REQUIREMENTS

2002

TEST COMPONENT	BASELINE	ANNUAL	TERMINATION	POTENTIAL OVER EXPOSURE
1. History and Physical	Yes	--	--	Specific
2. Update Occupational/Medical History	--	Yes	Yes	Yes
3. Complete Physical Exam by Physician	Yes	Yes	Yes	Yes
4. Vitals (Ht., Wt., BP, Temp, etc.)	Yes	Yes	Yes	Yes
5. Audiometric Exam	Yes	Yes	Yes	If Indicated
- Documentation of STS	N/A	Yes	Yes	If Indicated
6. Vision Test with Titmus	Yes	Yes	No	If Indicated
7. Electrocardiogram (EKG)	Yes	Age<40 every 3 yrs Age 40-50 every 2 years Age>50 every year	No	N/A
8. Chest X-Ray (2 views with Interp)	Yes	Every 3 years	No	If Indicated
9. Pulmonary Function Test (PFT)	Yes	Yes	Yes	If Indicated
10. Blood Chemistry Panel	Yes	Yes	Yes	If Indicated
11. Complete Blood Count (CBC)	Yes	Yes	Yes	If Indicated
12. Urinalysis with Microanalysis	Yes	Yes	No	If Indicated
13. Urine Heavy Metal Screen	If Required	If Required	If Required	If Indicated
14. Tetanus Booster (every 10 yrs)	If Indicated	If Indicated	No	If Indicated
15. Blood Lead & ZPP	If Required	If Required	If Required	If Indicated
16. Medical Clearance Form	Yes	Yes	Yes	Yes
17. Respirator Certification Form	Yes	Yes	No	Yes